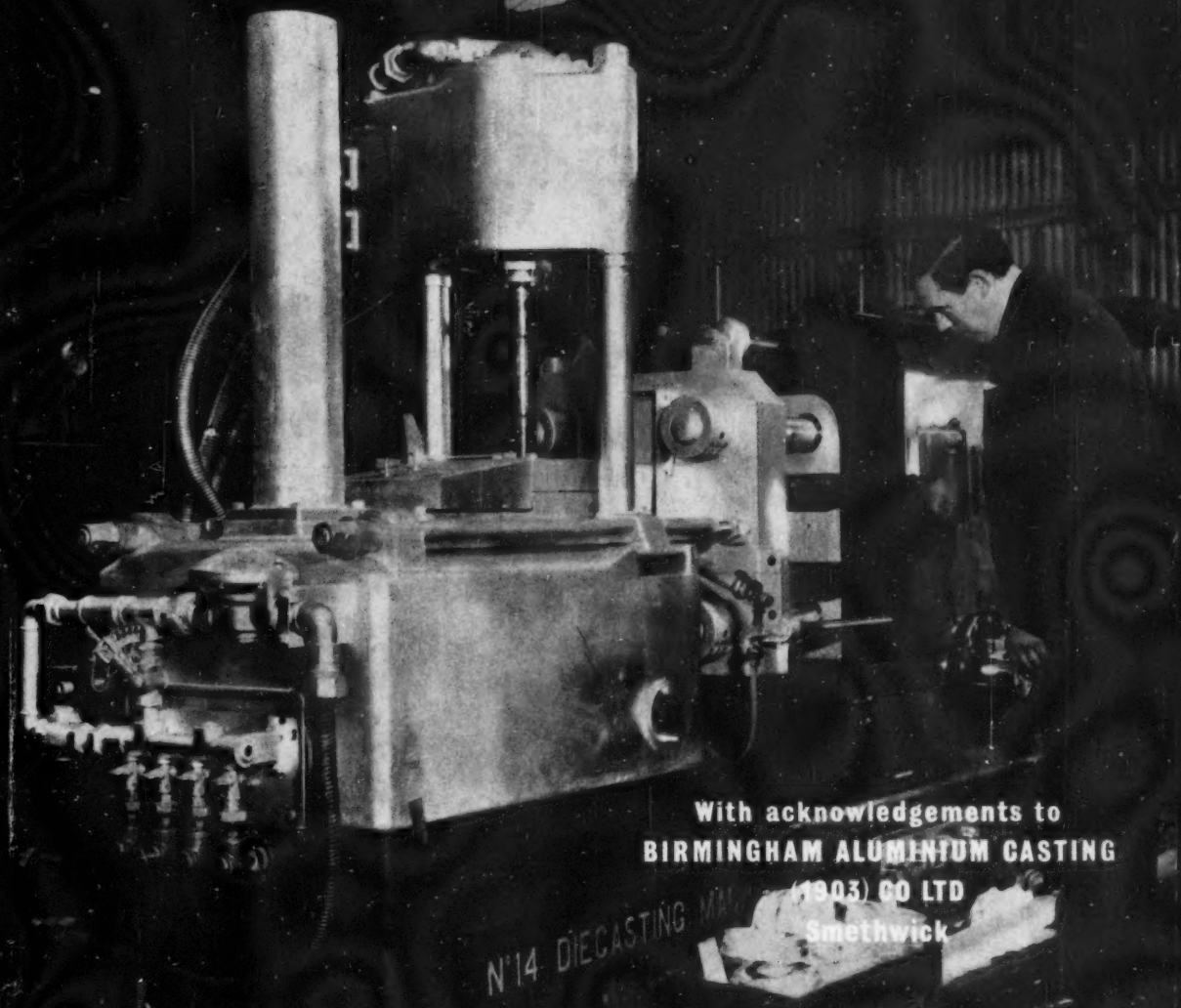
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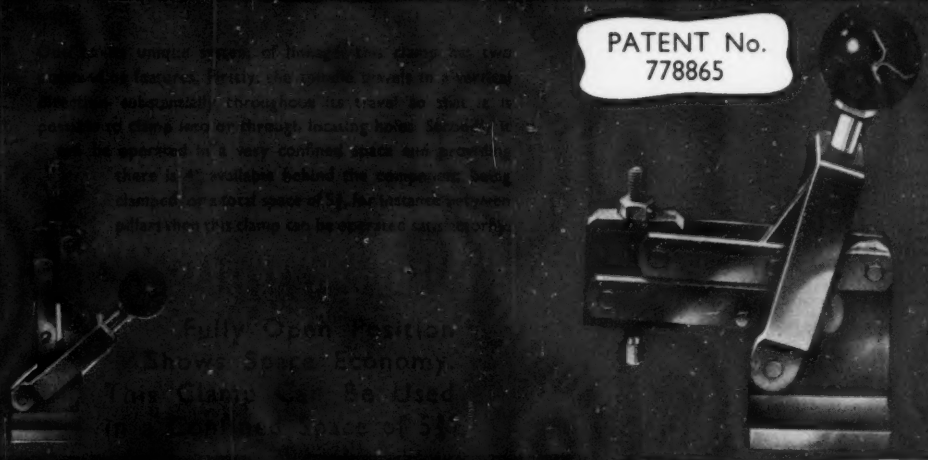


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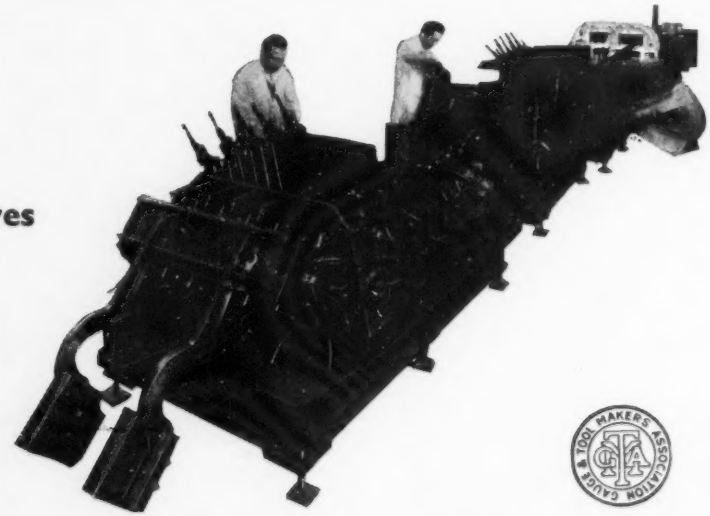
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AUTOMATION AND SPECIAL PURPOSE MACHINERY

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Where heat-treatment is concerned—are you doing the job as economically as possible? It's surprising the number of people who invest in expensive machine tools—and then spoil a good job in outdated furnaces. And the result? Rejects—time, money and probably customer goodwill lost. More and more people are relying on Wild-Barfield equipment. Write for full details of the Wild-Barfield range and see how you can save by changing to modern, electric furnaces.

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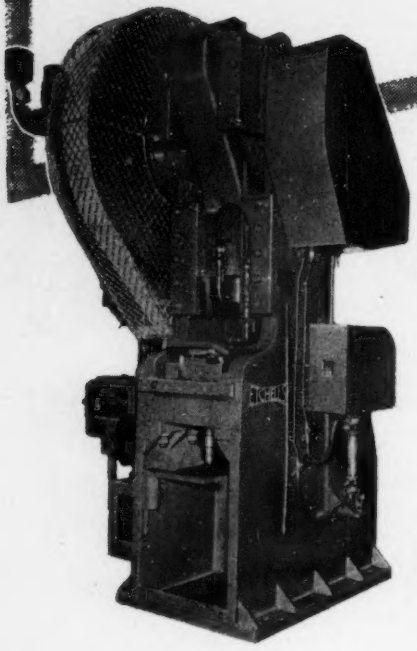
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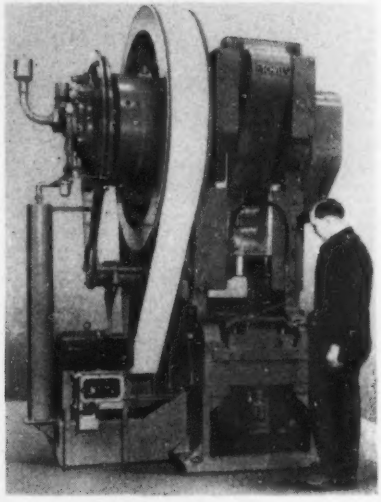
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Two minds with but a single thought —

HIGH PRODUCTION



No. 2 Etchells Vertical Forging Machine—write for details.



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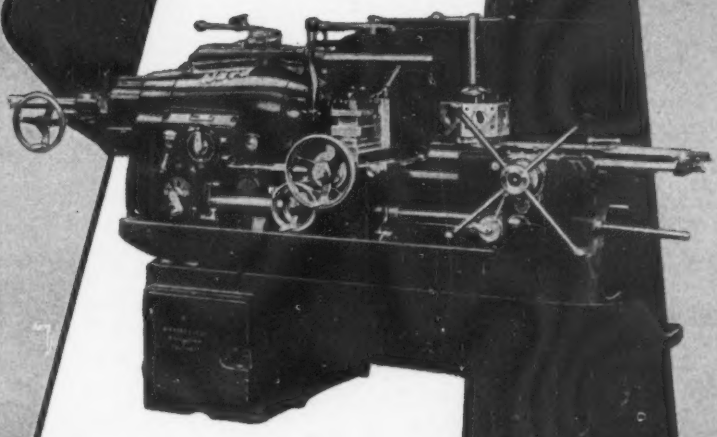
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Full details of our complete range of Capstan and Turret Lathes on request.

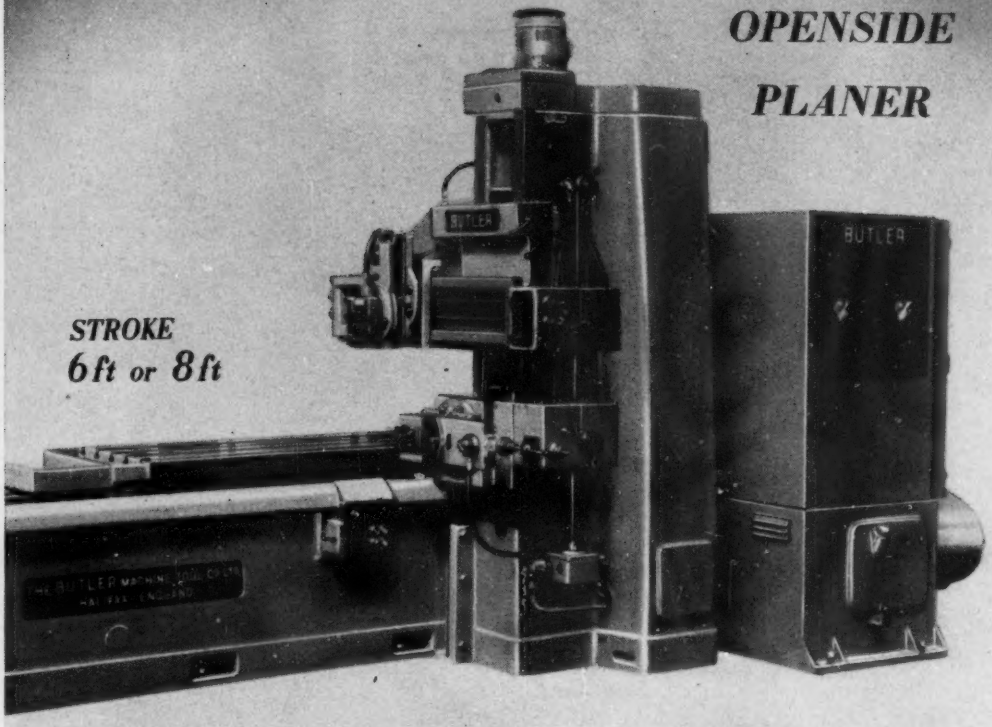
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STROKE
6 ft or 8 ft

Maximum stroke 6 ft or 8 ft	Work capacity 30 in. wide x 30 in. high under cross-slide
15 h.p. self-contained drive	Cutting speeds, low, 20 to 60 ft /min
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The BUTLER MACHINE TOOL Co. LTD.
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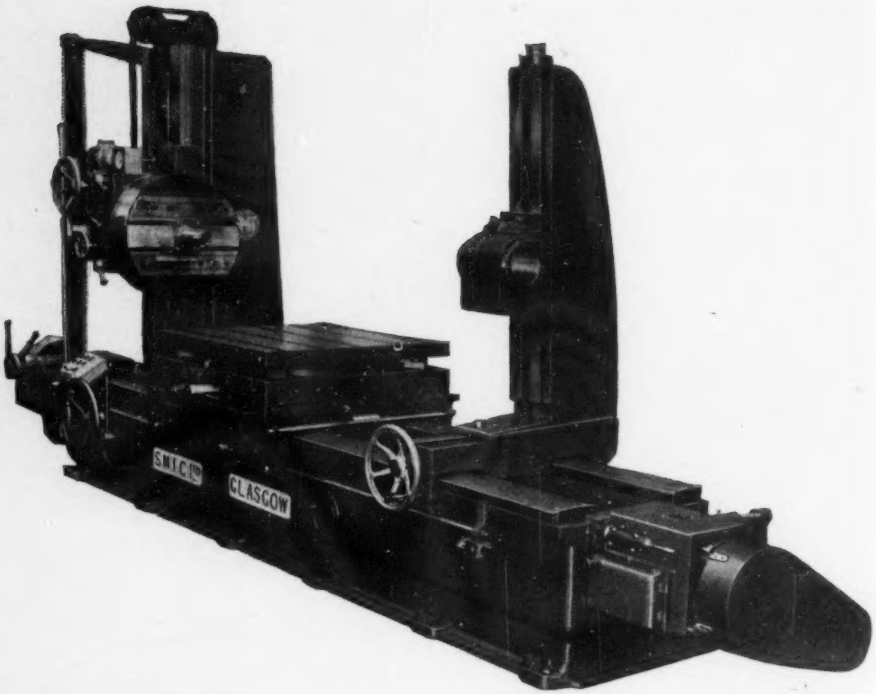
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B319


54·75" (52 min)
37·875" (32 min)
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2·5"
(13 min)
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PROFILING
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L217M

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facing and boring machines

These Type B facing and boring machines are designed to meet the growing demand for a simple yet robust machine with plenty of power for removing metal. Many users who find their own work growing increasingly specialised no longer need the great variety of features by which general purpose machines are made as versatile as possible. Type B machines are available with several different gearboxes, feed boxes, etc., so that the total outlay can be confined to the features which are actually required. Two basic sizes are available for facing up to 30" diameter and 48" diameter.
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CLYDE BUILT SMT GLASGOW MACHINE TOOLS



"What is it that you like most about REISHAUER?"



"Two things—remarkably high production and simplicity of setting and control."

"Do you get burning of the tooth-flank on the REISHAUER?"

"We did at first but found it was entirely our own fault through using the wrong types of grinding wheel."

"You grind on batch production but what happens if you have to grind a highly accurate gear?"

"No trouble on the REISHAUER—as a matter of fact we've ground master gears on the machine."

"You are gear grinding specialists and have added a REISHAUER ZA to a shop already filled with gear grinders. What then would be your advice to a firm who have not a single gear grinder and are wondering which would be the best choice to make?"

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"When you get the combination of coarsest D.P. and greatest helix angle do you get trouble with the grinding wheel producing the correct result?"

"We have in fact had this trouble but it was remedied by employing a compensated wheel form."

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FOR SPUR & HELICAL GEARS
NZA for gears ⅜" to 11¾" diameter, 5 DP.
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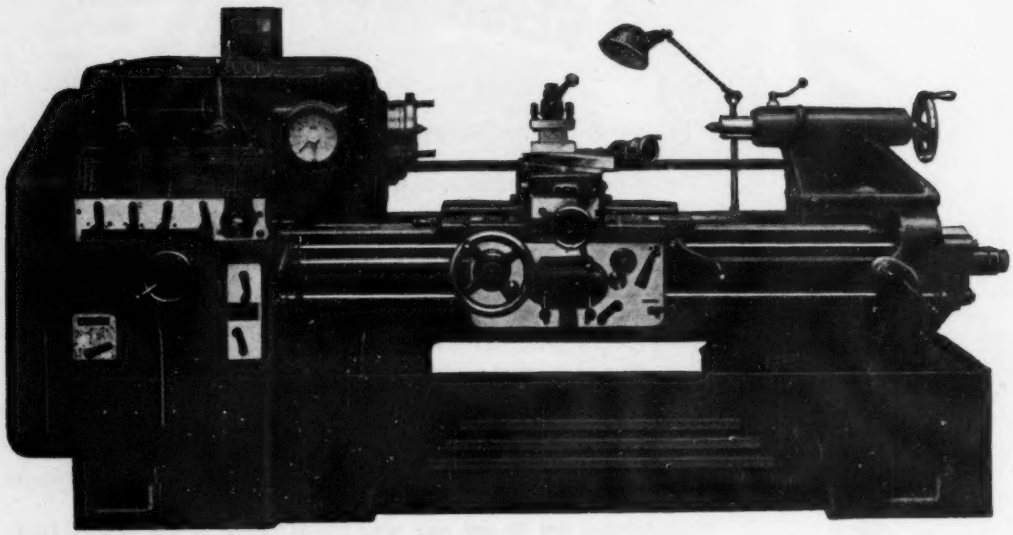
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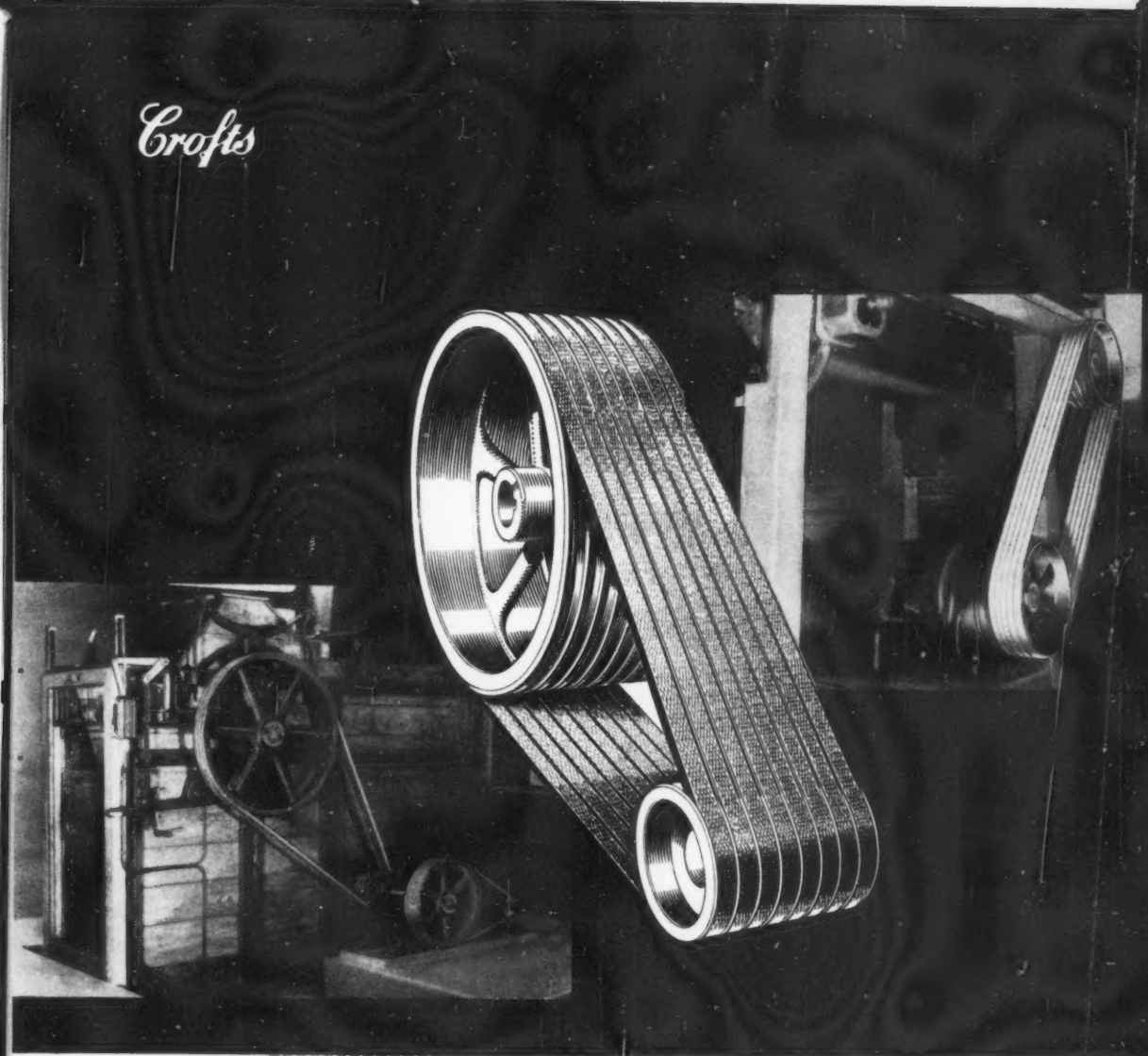
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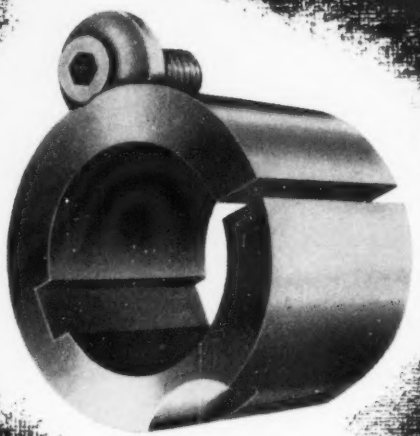
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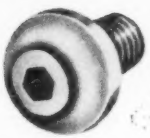
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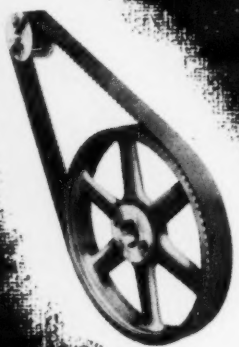
CROFTS (ENGINEERS) LIMITED
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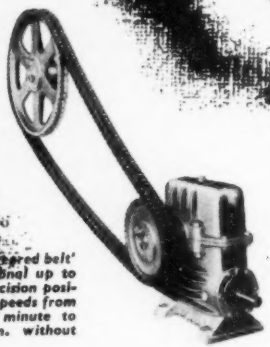
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Powerful 'V' grooved belt' Drives (sectional up to 300 h.p.; precision positive drive; speeds from inches per minute to 16,000 f.p.m. without slip.

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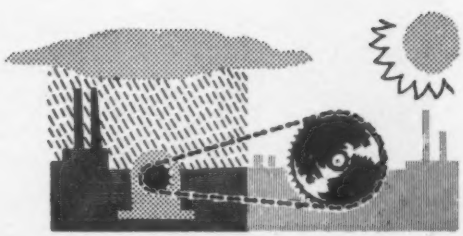
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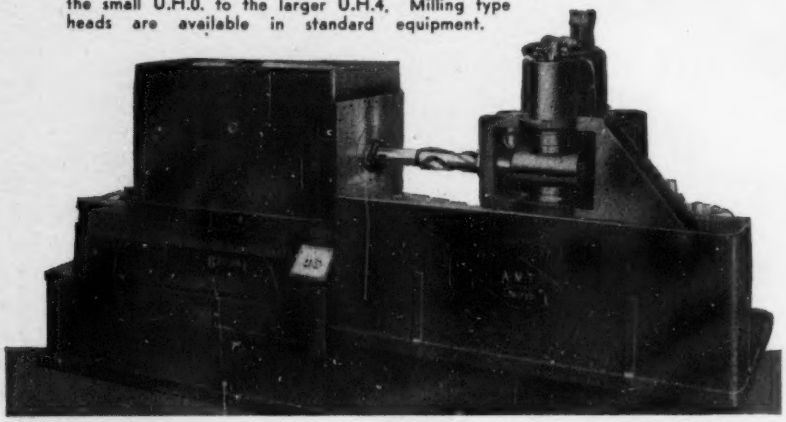
The complete range of Mark 5 chains complies in all respects with British Standard Specification No. 2947 : 1958.

THE COVENTRY
MARK 5 STEEL ROLLER CHAINS

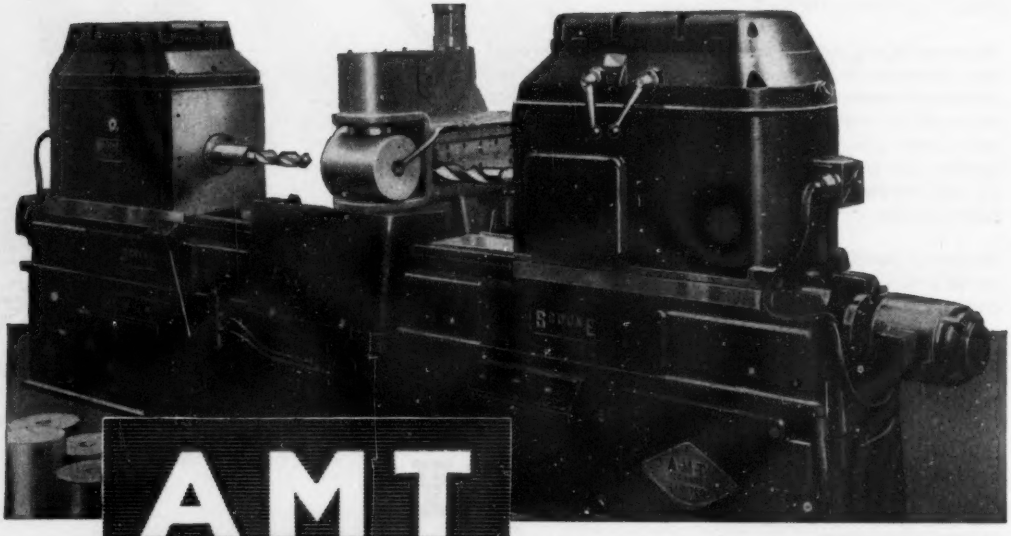
RENOLD — *the FIRST name in precision chain*

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Set-ups for any number and type of Unit Heads from the small U.H.0. to the larger U.H.4. Milling type heads are available in standard equipment.



Single and Double ended
BILLET DRILLING MACHINES



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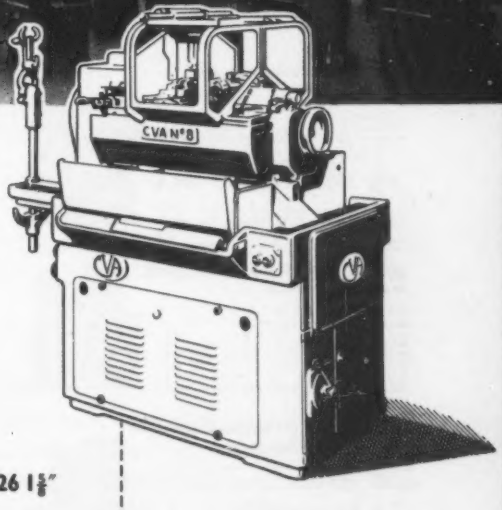
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Monarch

turns on CVA Automatics







More and more radio manufacturers are fitting B.S.R. MONARCH record changers, known for their unerring precision. To meet the resultant production demand, Birmingham Sound Reproducers Ltd., sought the best in automatic turning equipment and after extensive study their choice was CVA.

This battery of 32 No. 8 automatics was tooled and installed at the largest auto changer factory in Europe by CVA engineers.

Capacities available:—

No. 8 ½" – No. 12 ¾" – No. 20 1¼" – No. 26 1⅝"

CVA SINGLE SPINDLE AUTOMATIC SCREW MACHINES

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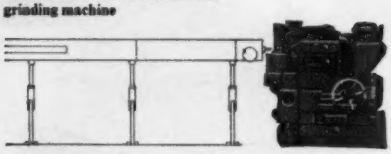
70% production boost for most bar-fed machines

Here are self-explanatory reasons why users report increases up to 70% with the BIRFEED:—

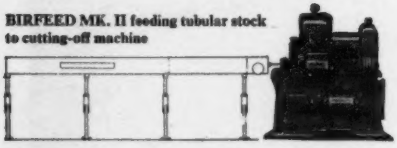
1. Reloading each bar takes only 7 seconds!
2. Magazine capacity 12—1" dia. bars
3. Magazine loaded by unskilled labour
4. No need to stop machine while magazine is loaded
5. Skilled operators can attend to more machines
6. Random lengths of stock can be used
7. **Actual productive machining time is increased, and machine tool efficiency can often exceed 85%**

BIRFEED (high-speed) adapted to suit electronically controlled automatic with hydraulically operated chuck

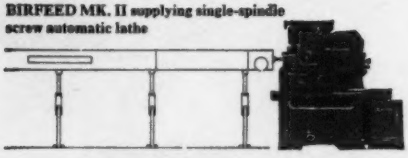
BIRFEED attached to centreless grinding machine



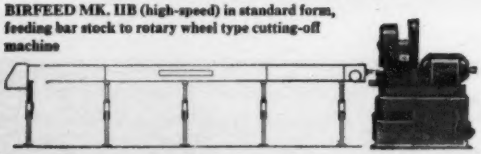
BIRFEED MK. II feeding tubular stock to cutting-off machine



BIRFEED MK. II supplying single-spindle screw automatic lathe



BIRFEED MK. IIB (high-speed) in standard form, feeding bar stock to rotary wheel type cutting-off machine



The BIRFEED Automatic Magazine Bar-feeding Attachment is readily installed: there is only one small modification necessary to the existing mechanism of a bar-fed machine tool. The BIRFEED is adjustable to the centre height of any machine. Standard BIRFEED attachments have been designed to suit the majority of modern capstan lathes, single-spindle screws, automatic lathes, and parting-off machines, but there are numerous other adaptations available to suit this outstanding equipment. Details of the BIRFEED models, including optional extras and adaptations will be forwarded on request.

Birfield

Birfeed

AUTOMATIC MAGAZINE BAR-FEEDING ATTACHMENT

BIRFIELD TOOLS LIMITED · BODMIN ROAD · COVENTRY

Phone: Walsgrave-on-Sowe 2372

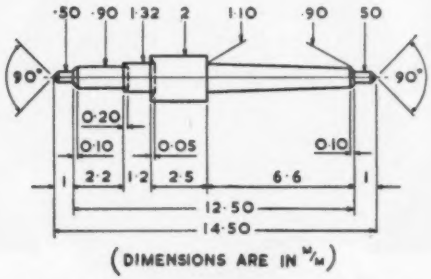
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Swiss-Type
BECHLER AUTOMATICS
renowned for producing work to a high degree of accuracy



C316

Bechler A.S.7 incorporates refinements which ensure a degree of precision and accuracy to meet the most exacting demands.



This steel pinion is produced in 36 seconds. Spindle Speed 3345 r.p.m. Cutting speed 74 ft. per min.

Machines available for producing the smallest watch components and for work up to $1\frac{3}{8}$" dia. x $8\frac{1}{2}$" long. Simple or complex work can be produced at high rates of production.

Four types, nine sizes, as follows:—

Type A — 2, 4, 7 and 10 mm. dia.
Type B — 12, 16 and 20 mm. dia.
Type C — 26 and 32 mm. dia.
"Isomatic", 4 and 7 mm. dia.

Range of machines also available with similar capacities as above and fitted with a 6-spindle revolving turret which reduces idle time to the minimum. Eleven tool positions available. Multi-diameter drills and reamers unnecessary. Up to four spindles can be used for screwing or tapping at one setting.

ALFRED HERBERT LTD., COVENTRY
Factored Division, Red Lane Works.

AD 231

HARPER CASTINGS AND BROOK MOTORS



Brook Motors Ltd., say:
"Appearance counts even for electric motors; Harper castings are smooth and free from blow holes or other surface faults. From a production point of view, Harper castings make smaller machining allowances possible with resulting freedom from tool breakage."

Harper quality covers Grey Iron, Spheroidal Graphite Iron (Mond-Nickel Licence) and Meehanite castings. Also metal pressings, machining, enamelling and other finishes and sub-assembly work.

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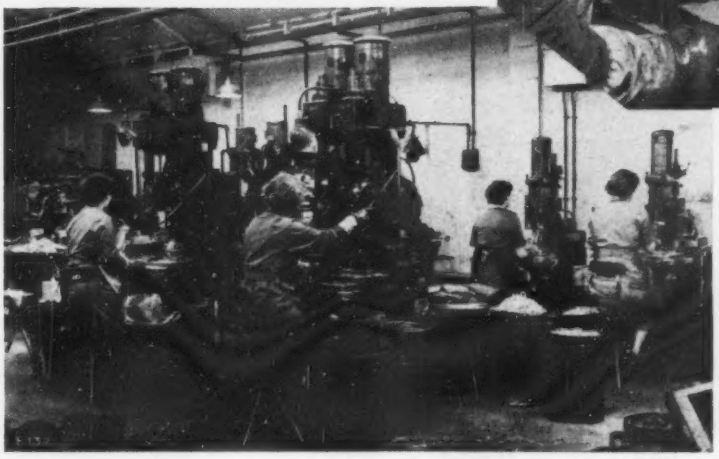
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30,000 shackles drilled and tapped per 44 hour week on —

- two **HERBERT** type C 2 spindle Drilling Machines
- two **HERBERT** Flash Tappers at William Hanke of Brierley Hill





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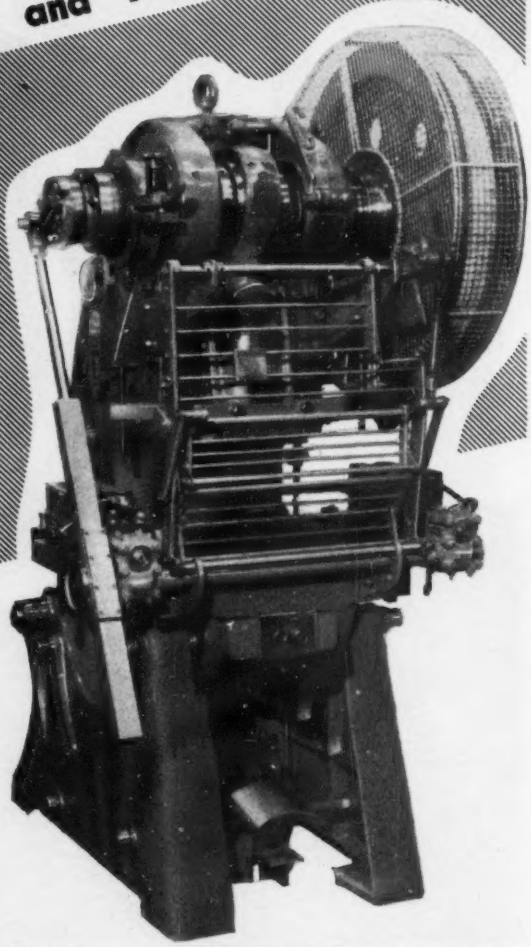
Up to 200 gross of shackles are tapped per regrind of the Herbert Ground Thread Taps.

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HUMPHRIS

Pressmaster 25 TON PRESS and RACK and PINION ROLL FEED



Although we have supplied a number of our 25 ton presses with rack and pinion type roll feeds fitted, this combination, until recently, has not illustrated an advertisement. In addition to the four feed models in the RF.0600 Series (single and double) and two models in the RF.0900 Series (single and double) which are fitted to this press we now have single and double versions of rack and pinion roll feeds in two widths which are available. In consequence there are now 16 variations of standard roll feeds which can be supplied as attachments to our 25 ton Crank Press and as will be seen from the illustration, interlock guards can be fitted to these presses for use in conjunction with the roll feeds. This important advantage allows the machine to be used for both primary and secondary operations.

HUMPHRIS

Pressmaster

25 TON ROLL FEED PRESS

HUMPHRIS

pacemakers of progress in presswork

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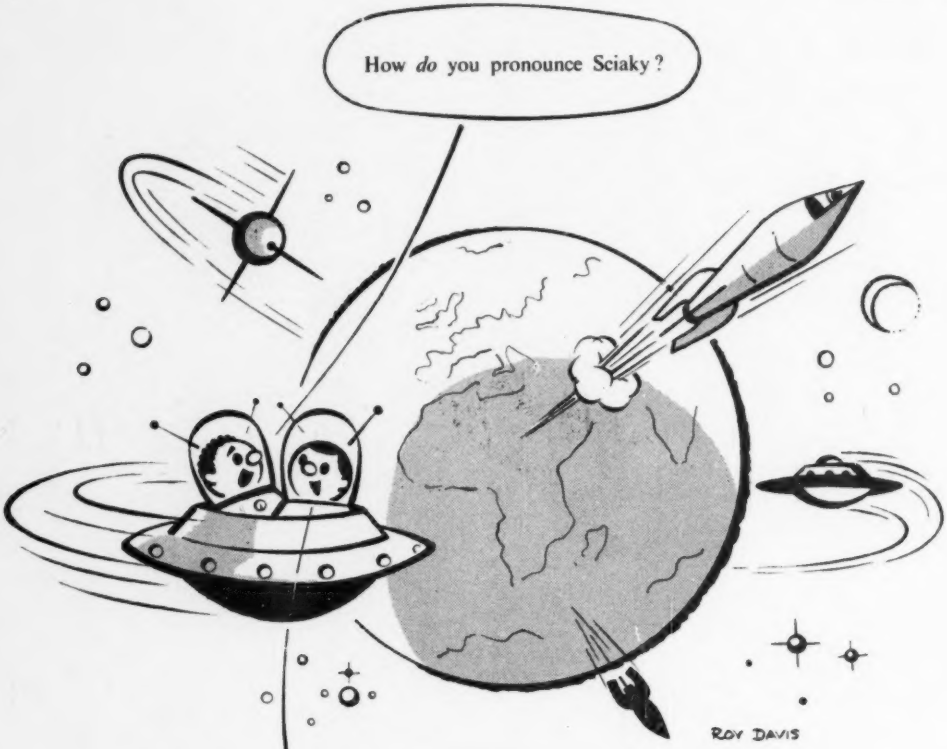
We are right on our "Metal"

Our long and unique experience in the design and manufacture of cutting tools is supplemented by the fact that we also produce the high grade steels from which they are made.

ENGLISH STEEL TOOL CORPORATION LTD

Openshaw, Manchester

Stocks also held at: 167 Dukes Rd., Acton, London, W.3; 62-64 Scotswood Rd., Newcastle; Holme Lane Works, Sheffield



You should have heard the boffins on that controversial subject the other day. Old boffin Sid for example.

He was saying that titanium satellites and nimonic space ships were fair game for SKY-ACKY welding.

"After all," he said, "saucepans, cages, bicycles, motor cars, missiles and aeroplanes are all SKY-ACKY welded."

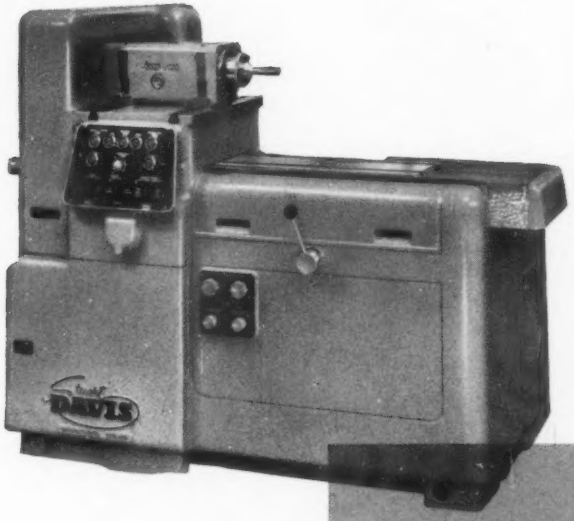
"You mean SHE-ICKY welded" squeaked boffin Emanuel. Then all the other boffins joined in: "SHE-ACKY," "SKY-ICKY," "SHI-ARKY," "SKEE-ICKY."

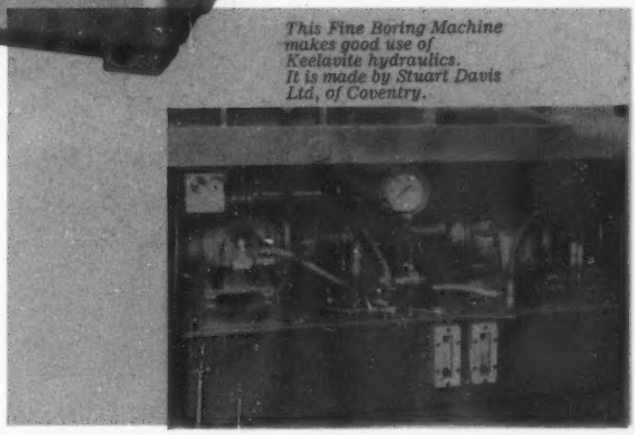
I myself pronounce it *SEE-ACKY*, which is, perhaps, how any self-respecting boffin would pronounce it.

SCIAKY ELECTRIC WELDING MACHINES LIMITED, FALMOUTH ROAD, SLOUGH, BUCKS, ENGLAND. TEL: SLOUGH 25551 (10 LINES) CABLES: SCIAKYWELD, SLOUGH

Paris Chicago London Birmingham Manchester Christchurch (N. Zealand) Calcutta Johannesburg Capetown Kuala Lumpur Bombay Bangalore Karachi

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This Fine Boring Machine makes good use of Keelavite hydraulics. It is made by Stuart Davis Ltd, of Coventry.

HYDRAULICS FOR MACHINE TOOLS

We at Keelavite are a team of experts in the design, installation and maintenance of complete hydraulic systems. We are ready to accept full responsibility for the proper working of all our installations, including all electrical or other control equipment.

Not only this, we are the manufacturers of the largest range of hydraulic units in the United Kingdom.

We are, of course, fully experienced in special applications of hydraulic power for the machine tool industry.

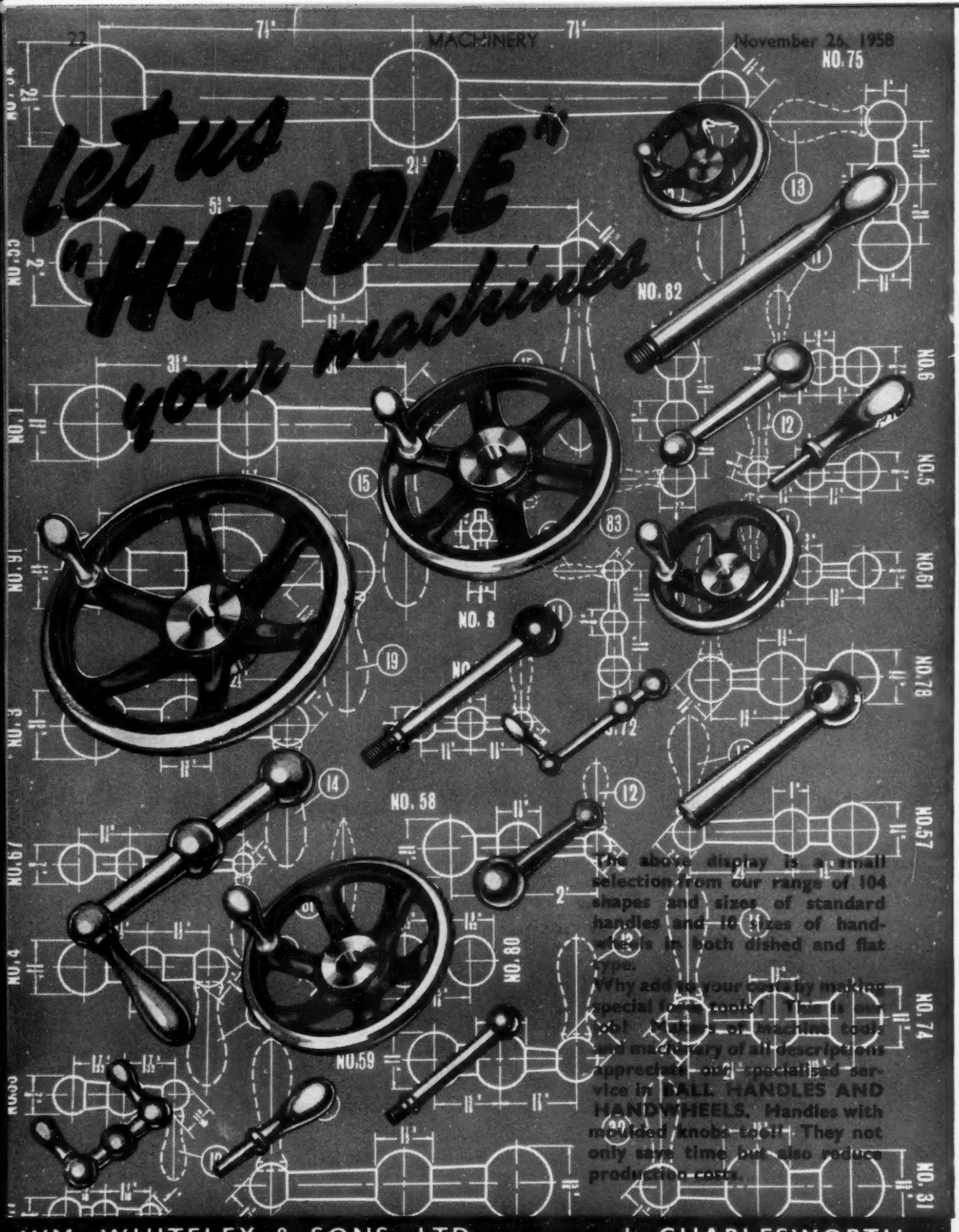
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Hydraulics
MACHINE TOOL DIVISION

THE RECOGNISED AUTHORITY

KEELAVITE HYDRAULICS LIMITED
ALLESLEY, COVENTRY Telephone: Meriden 441

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The above display is a small selection from our range of 104 shapes and sizes of standard handles and 10 sizes of handwheels in both dished and flat type.

Why add to your costs by making special forms yourself? This is our job! Makers of machine tools and machinery of all descriptions appreciate our specialised service in BALL HANDLES AND HANDWHEELS. Handles with moulded knobs to fit. They not only save time but also reduce production costs.

WM. WHITELEY & SONS, LTD. *incorporating* **J. CHARLESWORTH**

(MACHINE TOOL DIVISION) PROSPECT IRONWORKS, LOCKWOOD, HUDDERSFIELD, YORKS.

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makers of Machine Components since 1854

ABWOOD

WITH MOTORIZED CHIP-BREAKER GROOVE GRINDING UNIT



EQUIPPED WITH UNIVERSAL TOOLHOLDER

The Chip-breaker Groove Grinding Unit on the Abwood CG2/CB accommodates almost every shape and size of turning tool. Its robust design allows accurate grinding of grooves of desired radius and size with extreme accuracy and perfect finish.

UTILIZES DIAMOND WHEELS TO THEIR MAXIMUM EFFICIENCY

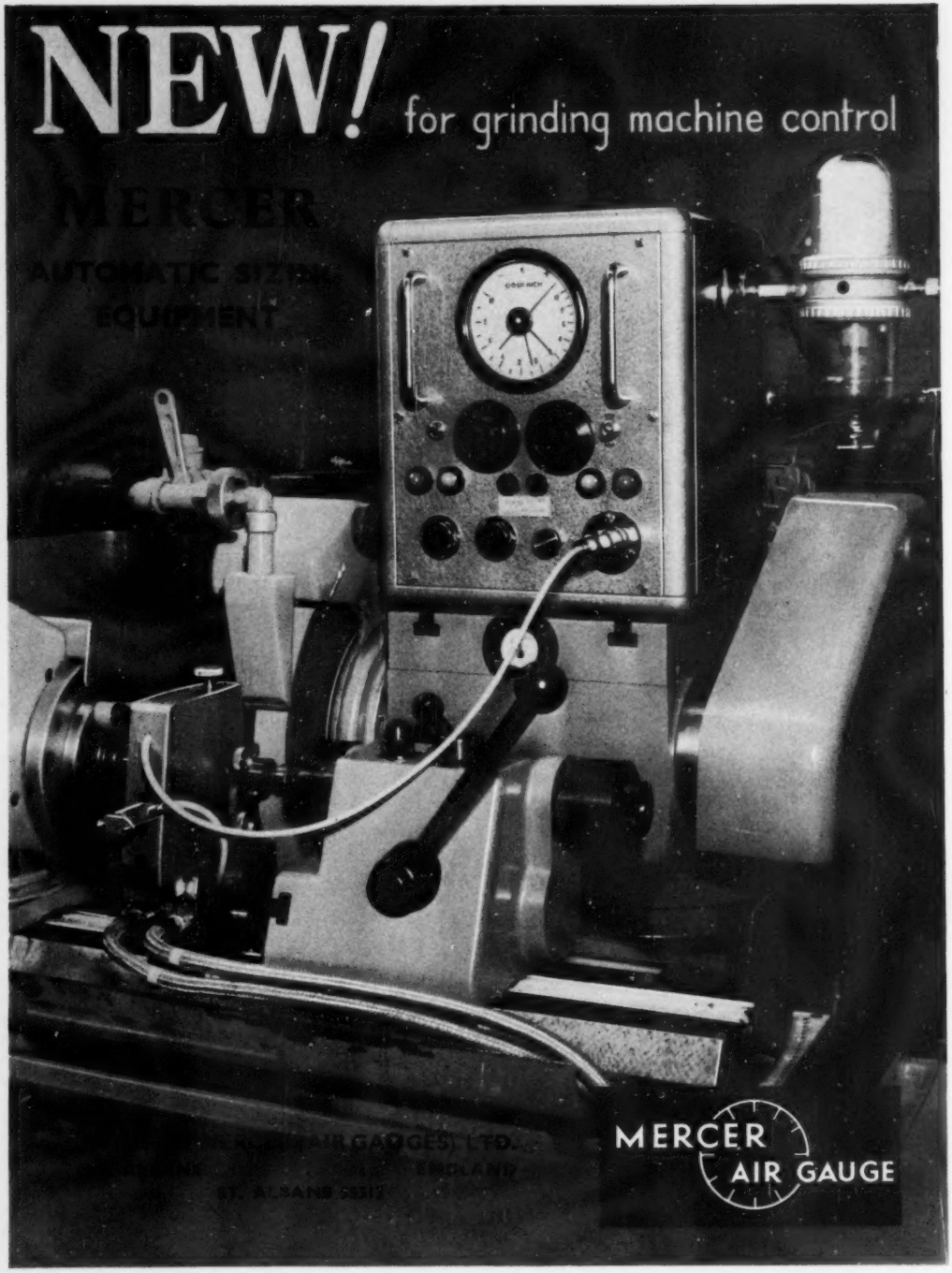
The ABWOOD range of Carbide Tool Grinders includes:

MODEL No.	WHEEL SIZES	AVAILABLE WITH:
CG0	6in.	Bench or Pedestal.
CG1	8in.	—
CG2	8in.	Chipbreaker Grooving Attachment.
CG3	12in.	
CG2/CB	8in.	Motorised Chipbreaker Unit
CG3/CB	12in.	

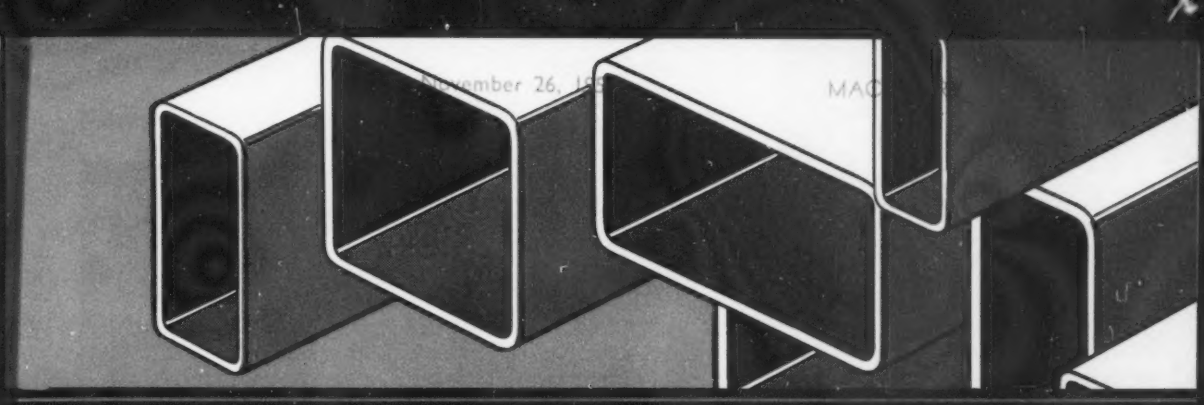
ABWOOD MACHINE TOOL [illegible] CES RD., DARTFORD, KENT

Telephone : Dartford 5271 (5 lines) *Telegrams : ABWOOD, DARTFORD*

C9/1



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A further advance in tubular steelwork:

RECTANGULAR HOLLOW SECTIONS



Welded tubular construction has made great progress in recent years in its applications to mechanical handling and similar equipment. A further step forward is being made with our new range of hot-rolled Rectangular Hollow Sections. These have been developed in conjunction with our subsidiary, Tubewrights Ltd., who are acknowledged specialists in tubular construction.

SIMPLICITY

R.H. Sections eliminate the need for special shaping of component members prior to welding. Any straight cut R.H.S. or tube will fit accurately against their flat sides whether square-on or at an angle and, moreover, lugs of various kinds produced from tube or bar are easily attached. Welding is simple and no bevelling is necessary.

SIZES

16 standard sizes of hot-rolled R.H. Sections are available, each in two thicknesses; they range from $1\frac{3}{8}$" square to 5" x $2\frac{1}{8}$". Several sections have matching dimensions and this is of advantage in the production of neat fabricated structures. The 1·90" square R.H.S., for example, matches the short sides of a 3·68" by 1·90" R.H.S.; these matching dimensions are made clear in our pamphlet, and in the accompanying table.

Our subsidiary, Tubewrights Ltd., of 25 Buckingham Gate, London, S.W.1, is willing to advise on or quote for any welded sub-assemblies or complete units in R.H.S., in tubes, or in a combination of both.

DIMENSIONS OF R H SECTIONS

□ INCHES	S.W.G	▯ INCHES	S.W.G
1·36 x 1·36;	11g, 10g	2·44 x 1·36;	11g, 9g
1·90 x 1·90;	11g, 9g	3·17 x 1·59;	10g, 9g
2·125 x 2·125;	10g, 9g	3·68 x 1·90;	10g, 8g
2·38 x 2·38;	10g, 9g	4·76 x 2·38;	9g, 7g
2·50 x 2·50;	10g, 8g	1·90 x ·82;	11g, 10g
2·79 x 2·79;	10g, 8g	2·79 x 1·01;	11g, 9g
3·57 x 3·57;	9g, 7g	3·40 x 1·36;	10g, 9g
MATCHING DIMENSIONS ARE SHOWN IN HEAVY TYPE		3·99 x 1·59;	10g, 8g
		5·01 x 2·125;	9g, 7g

STEWARTS AND LLOYDS WAREHOUSES THROUGHOUT THE COUNTRY STOCK R.H.S.

Pamphlet giving full dimensions, properties and prices will be sent on application to:

Stewarts and Lloyds Ltd

STRUCTURAL STEEL DEPARTMENT,
BROAD STREET CHAMBERS, BIRMINGHAM, 1

STEWARTS AND LLOYDS S&L RECTANGULAR HOLLOW SECTIONS TUBEWRIGHTS

HARRIS

My best bet is to ring ***Harris Tools*** *– they will send the taps, dies and gauges immediately*







A RICHMOND No. 1 Universal Milling Machine at work at Imperial Chemical Industries Limited's Wilton Works. (Many famous names figure in our order-books!)

No. 1 UNIVERSAL MILLING MACHINES

I.C.I.

(WILTON WORKS, MIDDLESBROUGH)

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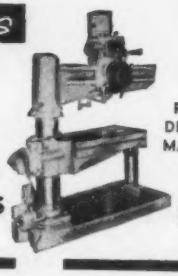
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HILLIDGE WORKS, LEEDS 10. Telephone: Leeds 76032/3

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STANDARD BUSHES
are now available in
HOLFOS BRONZE



Suitable for many different requirements, these bushes are produced from high grade materials from our own foundry and confirm to B.S.I. specifications. Rigid metallurgical control and constant inspection in all stages of manufacture combine to make them of very high quality.

new illustrated brochure

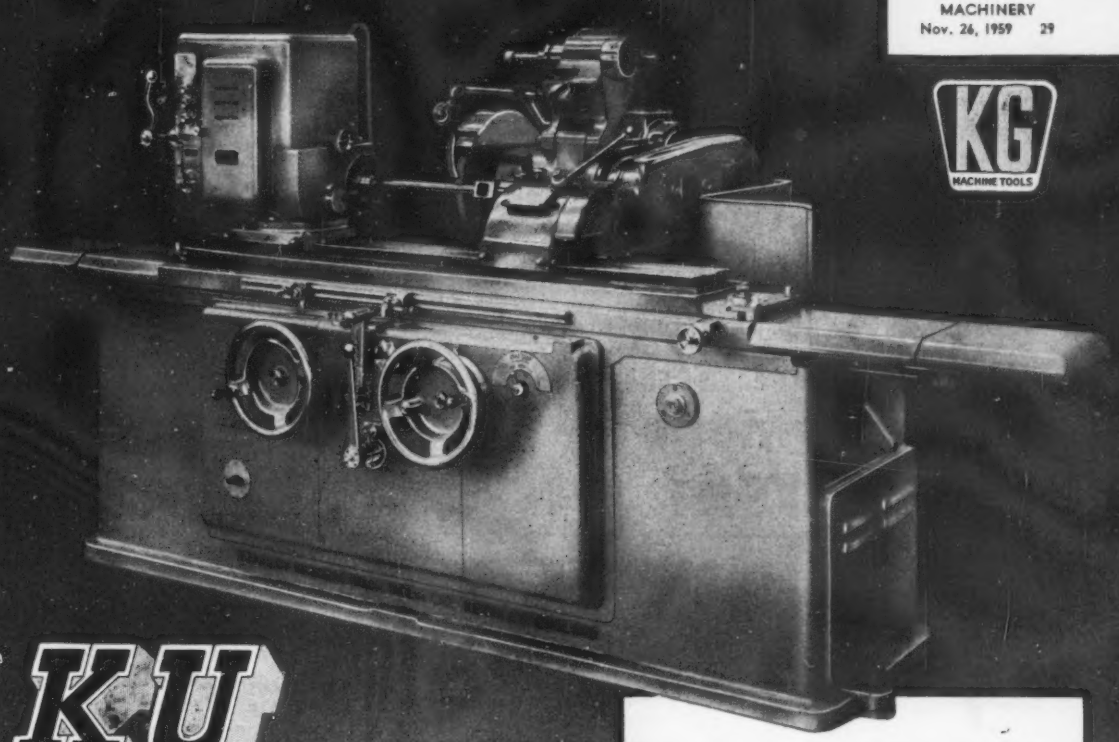
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BILLETOP & GILPIN LTD.

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Always Specify HOLFOS BRONZE STANDARD BUSHES

KG MACHINE TOOLS



KU

UNIVERSAL GRINDING MACHINE

Exceptionally sturdy and versatile, Keighley K.U. *fully* universal grinders have an unsurpassed reputation for quality and reliability. The basic machines are designed for external, internal, face and taper grinding while a comprehensive range of additional equipment considerably augments their flexibility for small or medium size batch production. Robust construction asures long life and design features give maximum production economy combined with unexcelled accuracy and finish of components.

22 MODELS AVAILABLE

capacities: 12″ x 24″ to 24″ x 96″

size range:

STANDARD
12″ x 24″ to 12″ x 60″

MEDIUM HEAVY
16″ x 24″ to 16″ x 60″

HEAVY DUTY
18″ x 24″ to 18″ x 96″
24″ x 24″ to 24″ x 96″

Products of

KEIGHLEY GRINDERS (MT) LTD KEIGHLEY YORKS

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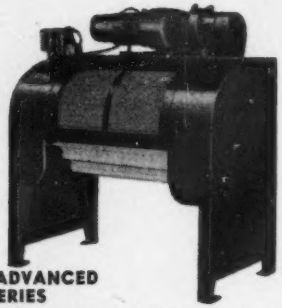
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ALMCO

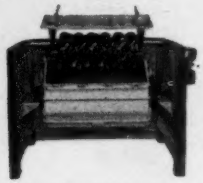
has the right barrel finishing equipment for you!



Model DB 200

ALMCO'S "ADVANCED DESIGN" SERIES

Thirteen great models in this series! These machines feature a wide range of variable speeds (infinite from 6 to 30 r.p.m.), making possible economical deburring and finishing of the greatest variety of parts. Each unit has Almco's exclusive design features and rugged construction to stand up under all types of punishing applications.



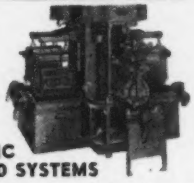
"FIXTURE" TYPE BARRELS

Pioneered by Almco for processing large and intricate parts. Custom designed fixtures hold parts securely, prevent part-on-part impingement and allow abrasive action to reach all surfaces, cavities, slots, etc. Barrels have automatic forward and reverse controls.



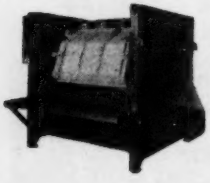
MULTI-COMPARTMENT BARRELS

Do you have these deburring and finishing problems—wide variety of parts or small quantity runs where fixtures would be too costly? Lack of floor space for several machines? An Almco custom-designed multi-compartment barrel may give you a cost-saving answer. Automatic forward and reverse. Any combination of compartments and doors.



SUB-O-MATIC AUTOMATED SYSTEMS

Almco's exclusive submerged unit is an automatic, "assembly line" system for micro-precision deburring and finishing of small parts in quantity. Saves labour, speeds up processing and flow of high production parts. One man can operate this equipment and handle as many as 192 barrel loads per 16 hr. day. Slashes compound expense to minimum. These submerged systems can also be obtained in non-automated, straight line systems.



CUSTOM-DESIGNED BARRELS

Almco designs and manufactures special barrels of all types for problems where standard equipment cannot be effectively used. These range from the smallest type to the largest fixture barrel such as the 60" diameter x 60" length barrel shown above. Special large diameter barrels with double flat or triple flat doors are also available to accommodate extra large parts and to allow abrasive media to flow freely over the outer periphery of the part. Your special problems may be solved with one of Almco's custom-designed barrels.



Model DB 01A

SMALLER MACHINES

Twin barrel machines manufactured by Almco are the standard of the industry for processing small lots of parts and for companies with large lots of small parts. Also ideal for sample processing, barrel finishing research and development work. These units are Almco engineered to the highest specification standards and include operational and safety features found on larger Almco machines.



YOUR SAMPLE PARTS PROCESSED without obligation in modern Almco test labs. Simply send parts direct to Hitchin, Herts. Enclose specifications desired. Complete free report includes recommendation.

Almco deburring and finishing machines are ruggedly constructed to perform on a round-the-clock basis. They incorporate the best engineering design required in the industry—your assurance of versatility and economical processing of work parts. Optional equipment includes material handling devices and systems, automatic forward and reverse, double or triple flat doors, single and dual timer controls for automatic delay starting and stopping, perforated drain doors for flushing and rinsing unloading devices, etc. Also a full and complete line of Almco Supersheen barrel finishing compounds and media of all types made especially for use with Almco precision barrel finishing equipment.

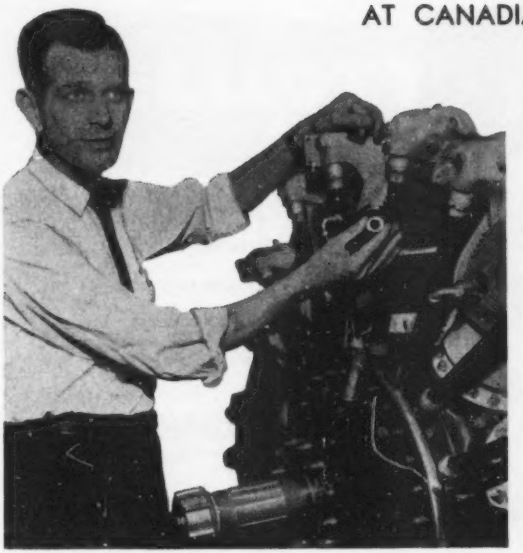
ALMCO Supersheen

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Telephone: Hitchin 3669

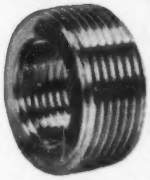
HOLLAND (Rotterdam) N.V. Technische Handelsonderneming "Carborundum-Aloxite" : **BELGIUM & LUXEMBURG (Bruxelles)** Tecnimetal Societe Anonyme : **SWEDEN (Stockholm)** Trumlingsaktiebolaget : **SWITZERLAND (St. Gallen)** L. Kellenberger & Co. : **SOUTH AFRICA (Johannesburg)** Barry Colne & Co. (Pty.) Ltd. : **AUSTRALIA & NEW ZEALAND (Melbourne)** Hardie Trading Ltd.

AT CANADIAN PRATT AND WHITNEY AIRCRAFT



ALMCO

barrel finishing SAVES 97% on deburring and finishing of spark plug bushings



● **SAVES 9d. ON EACH BUSHING**—Deburring and finishing threaded spark plug bushings like the one shown at the left, formerly cost £37.4.0 per thousand when CP & W used speed lathes, portable power tools and other hand methods.

After installing two ALMCO DB-200 Supersheen units, records showed a cost cut of 97%. This equipment turns out 1,000 bushings in 45 minutes, releases grinders and finishers to other duties. Cost reports showed:

£37.4.0	cost per thousand with power tools.
£ 1.1.0	cost per thousand with 2 ALMCO barrels.
£36.3.0	Savings per thousand pieces.

This year CP & W will process 24,000 spark plug bushings, with a total savings of £867.10.0 on this one part alone.

PRACTICALLY ELIMINATES REJECTS—Before installing controlled-type barrel finishing, parts inspectors returned for re-work an average of 125 bushings out of every 1,000 (12½%). With Almco Supersheen equipment and processes, these parts are now finished to a degree of uniformity that is virtually free of rejects.

CUTS DEBURRING AND FINISHING COSTS £867.10.0—Threaded spark plug bushings used in famous Pratt & Whitney aircraft engines will be deburred and finished for £867.10.0 less this year with Almco equipment and processes. Maurice Harrison, Supervisor of Process Planning, shows the small part on which this saving will be made.

DESIGNED FOR MANY METAL FINISHING OPERATIONS—In addition to deburring and finishing, ALMCO equipment and processes are used for descaling, degreasing, grinding, burnishing, work-hardening, rust-inhibiting, polishing, etc.

ALMCO SUPERSHEEN materials, equipment and processes have been developed by engineers and technicians fully trained in all the intricate variables of modern barrel finishing applications.

FREE SAMPLE PROCESSING. ALMCO has ample facilities for running sample parts. Send sample components, with your specifications to our Process Laboratory, your enquiry will be handled promptly. You'll get a complete report on where you can save deburring and finishing costs, improve product quality and appearance, the method and machine best suited for your operation. GET THE FACTS TO-DAY.



Two Model DB-200 Almco machines, using Supersheen bonded abrasive chips and compounds, deburr and polish 1,000 spark plug bushings in 45 minutes at Canadian Pratt and Whitney.

ALMCO Supersheen

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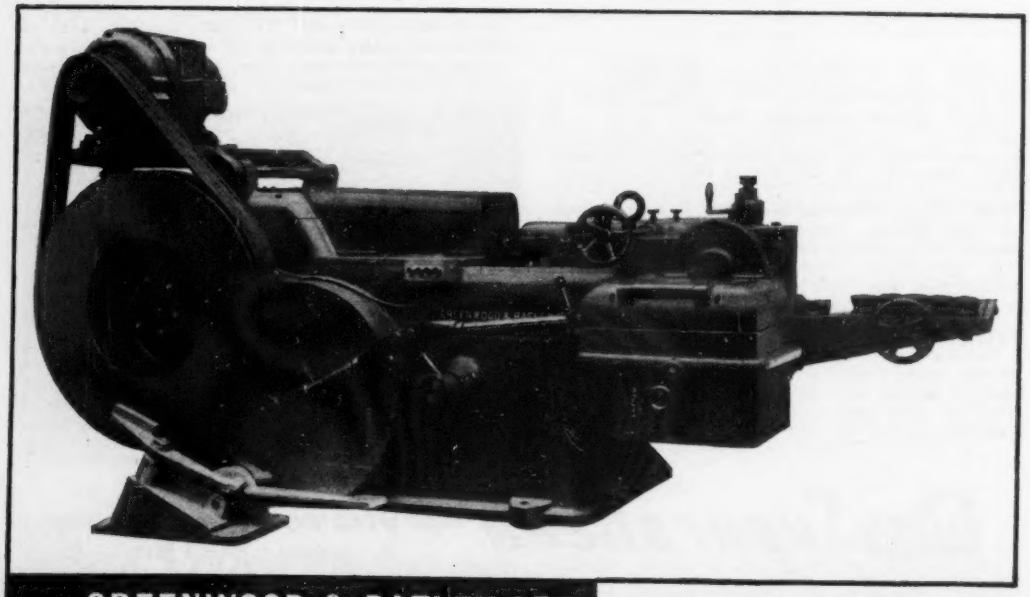
GREENBAT

high speed cold forging machines

The machine illustrated is a Greenbat HIGH SPEED Cold Forging Machine, giving rapid production of accurate cold forged components comparable with machine components but at much less cost in material and production time. This high speed range of machines is available in sizes $\frac{1}{8}$" to $\frac{1}{2}$".

Also available is the standard range of Cold Forging Machines, handling sizes from $\frac{1}{8}$" to $\frac{3}{4}$".

SOLID DIE, SINGLE & DOUBLE BLOW



GREENWOOD & BATLEY LTD. **ALBION WORKS, LEEDS 12**

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VICTORIA MILLING MACHINES

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of their

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Visit us and inspect the many New Models exhibited for the first time

All machines demonstrated under power

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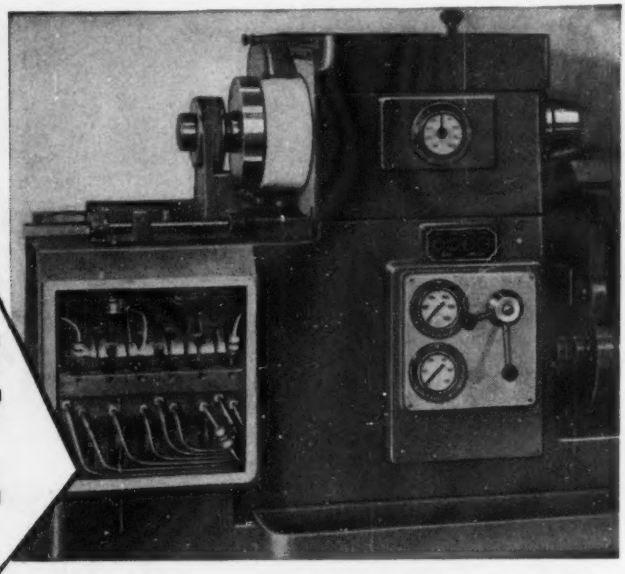
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HYDRAULIC CONTROL

for GREATER FLEXIBILITY — GREATER PRODUCTION CAPACITY

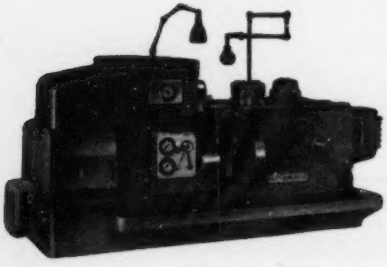
BUTTERWORTH HYDRAULIC AUTOMATIC

cuts costs on short or long runs

• ADVANCED DESIGN • NEW STANDARDS OF PRODUCTIVITY • INFINITELY VARIABLE SPEED CONTROL • NO SPECIAL CAMS

Here is a machine to meet to-day's demand for lower costs. Ample power, combined with foolproof hydraulic control of feed, elimination of special cams, and great flexibility ensure the highest possible production rates, even on small batches. Note, too, the chucking and bar feed are hydraulically operated.

The range of sizes covers work from 1⅜" to 2½" diameter bar. Hydraulic copy turning attachment and cross slide longitudinal turning attachment available. Other sizes and models include ⅞" SD, ⅞"-1 1/16" SD, 1¼" AG, 3" AG and 3½" AG.



Write for complete details:

BUTTERWORTH

BRITISH AUTOMATIC MACHINE TOOL CO. LTD.

LINCOLN STREET, ROCHDALE

When it comes to Value for Money—

IT PAYS TO TURN ON

COLCHESTER

IMMEDIATE DELIVERY!



STUDENT
6" × 24" Safety Lathe
Including full Electrical Equipment **Only £349**

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5" × 20" High Speed Precision Lathe
Including full Electrical Equipment **Only £320**

Also Available
MASTER 6½" × 36" All Geared Lathe
TRIUMPH 7½" × 30" & 48" Heavy Duty Lathe
MASCOT 8½" × 54" & 78" All Geared Lathe

Inspect these and other machines in our showrooms.

ROCKWELL
MACHINE TOOL CO LTD

For further particulars write or telephone TODAY

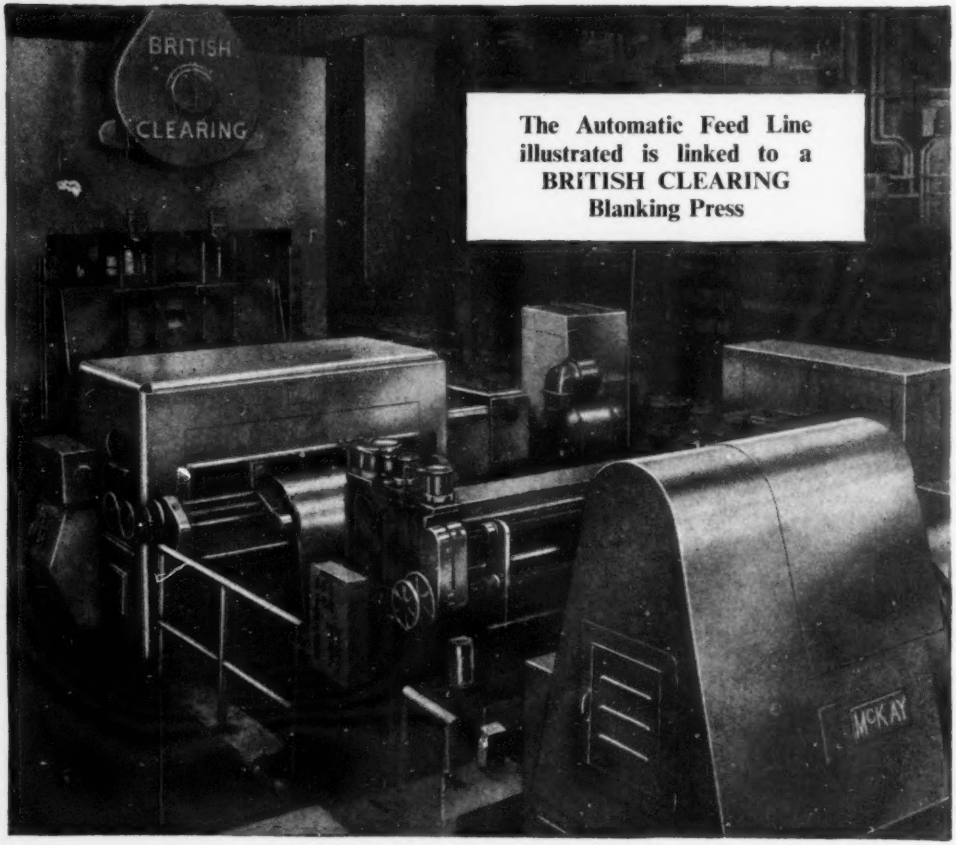
WELSH HARP, EDGWARE RD., LONDON, N.W.2. TEL: GLADSTONE 0033

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C2 C★

McKAY Automatic Feed Lines

for *Decoiling, Straightening, Washing etc*



McKAY McK MACHINE

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Conditions steel prior to fabricating, thus eliminating stretcher strain, minimising tearing and improving drawing quality.

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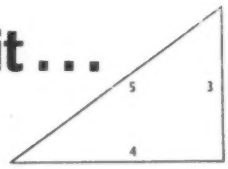
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The GREEKS

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had a word for it . . .



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Later in the day came the use of the right-angled triangle for accurate angular measurement in engineering, using a simple sine bar consisting of two rollers fitted to a steel bar at set centres.
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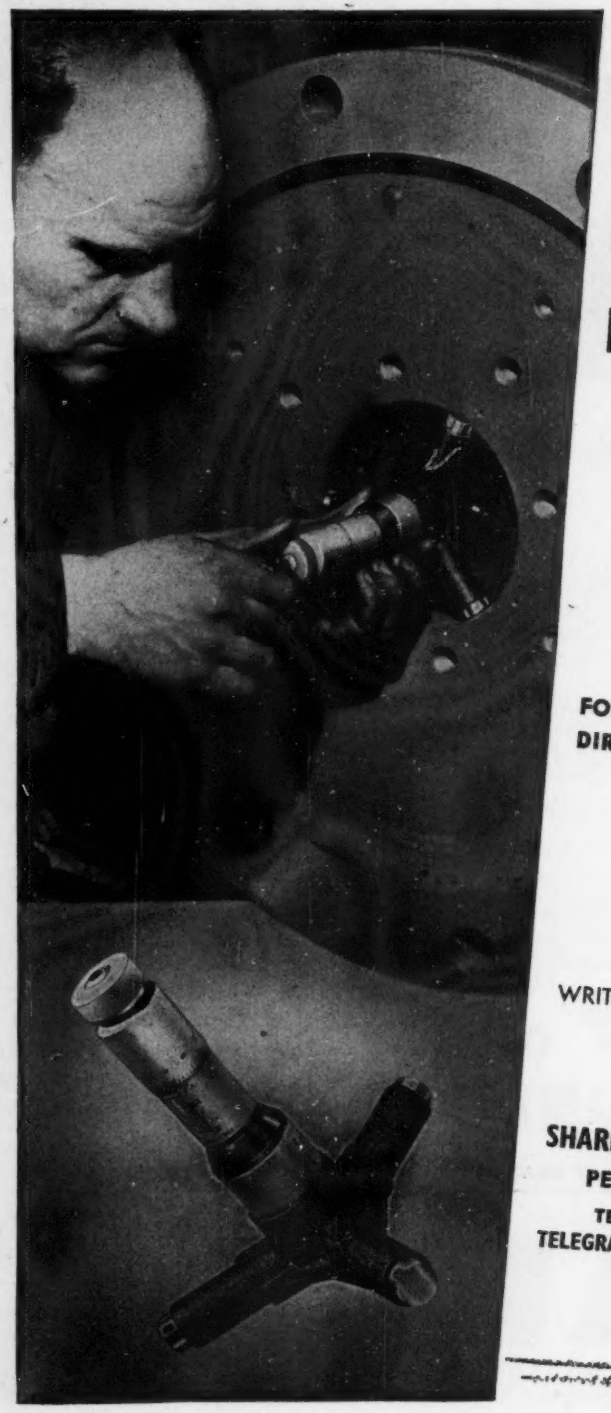
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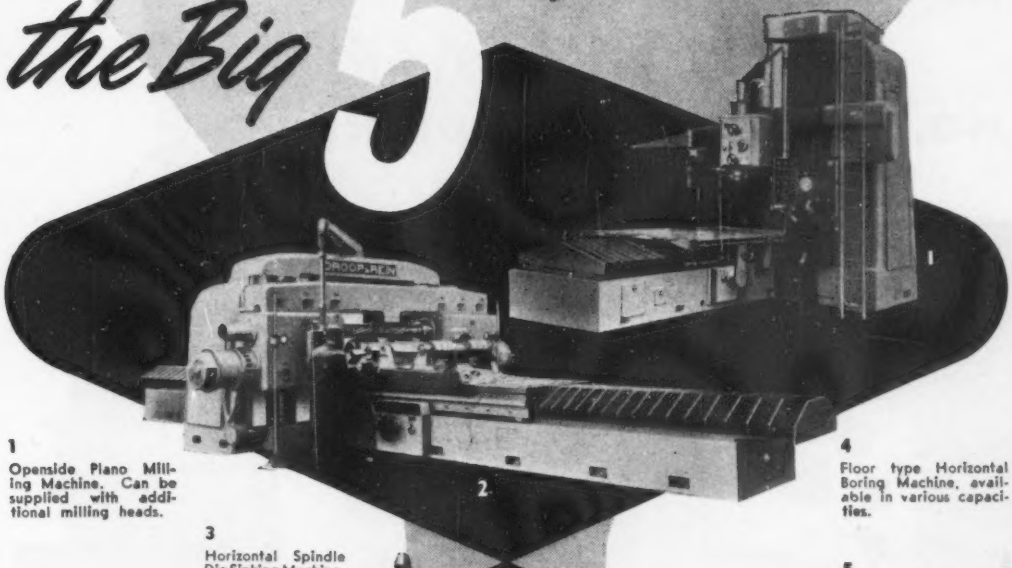
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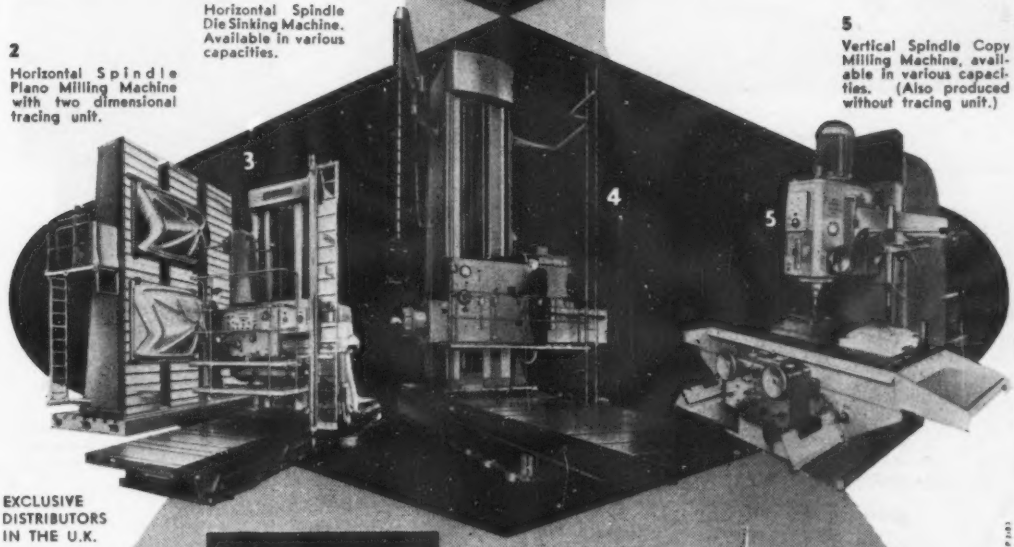
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Openside Plano Milling Machine. Can be supplied with additional milling heads.

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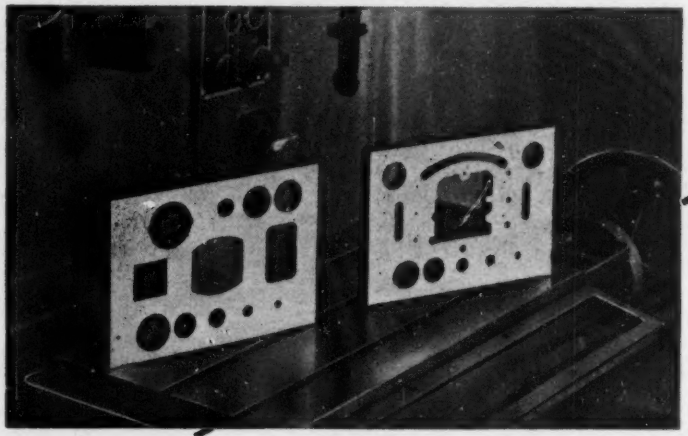
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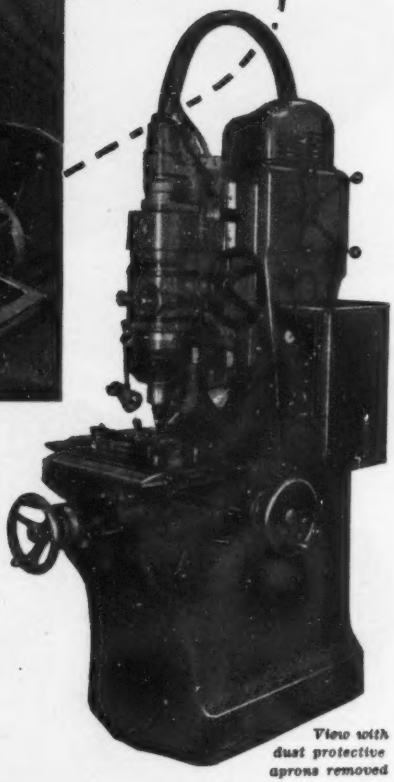
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MOORE-CATMUR

NO. 2 PRECISION JIG GRINDER

Samples showing the possibilities of this machine





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Designed for the accurate location and grinding of

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Straight or tapered

CONTOURS
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Especially suitable for the production of accurate press tools; Table size 10" x 19"

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NRP 1440

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Photograph by courtesy of Ford Motor Company Ltd., Dagenham

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A thousand MORGANITE CARBON BEARINGS undergo severe treatment to make this possible—caustic solutions; cold water; bonderising acids; hot water; cold air and finally 400°C in an oven!

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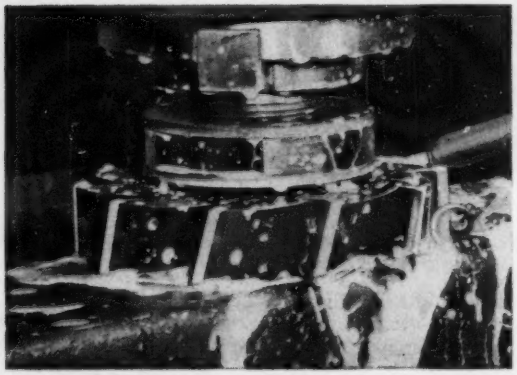
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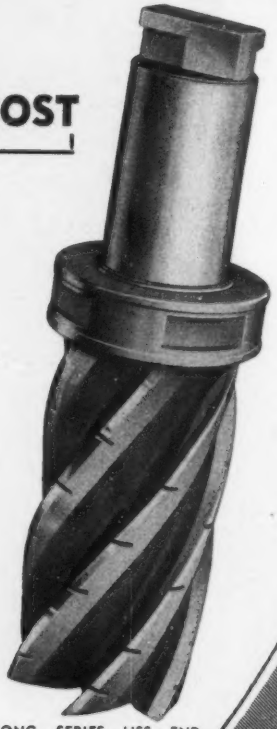
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6" dia. "Stellite" tipped facemill machining .60/.65 carbon steel. 4" wide x ¾" deep at 5¾" feed removing 8.80 cu. ins. per min.



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CUT BETTER WITH "Clare"

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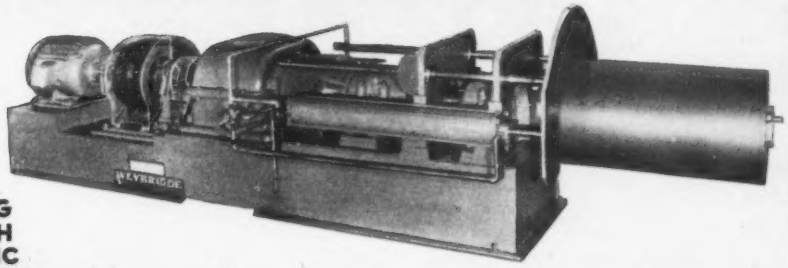
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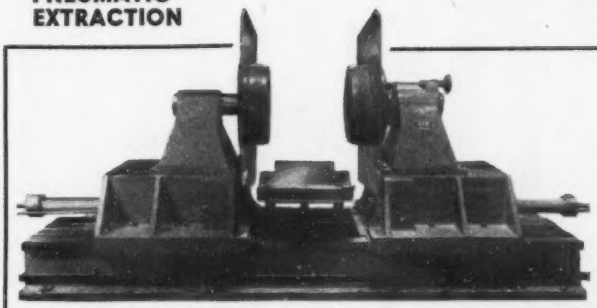
No. 7 of a series illustrating the Clare Milling system.

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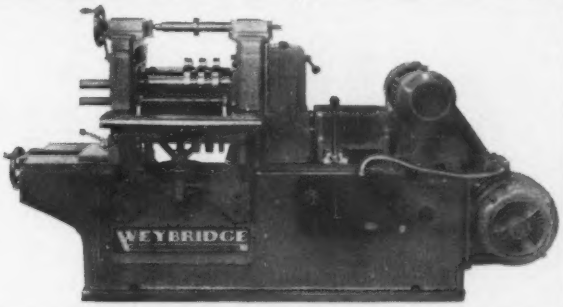
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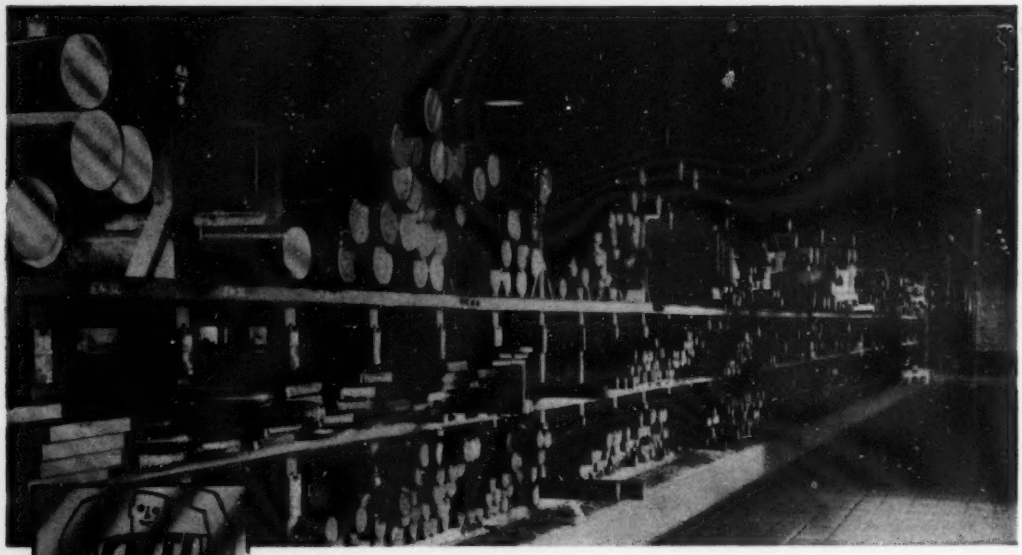


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MR. STEEL'S NEW WAREHOUSE FOR HOT ROLLED CARBON & ALLOY STEEL BARS

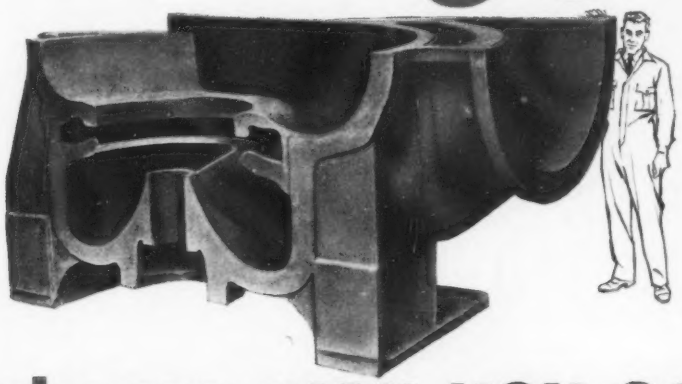
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Very large stocks are held and the warehouse is completely equipped with the modern facilities required to maintain the quick delivery service for which Macready's are famous. Production delays are eliminated when you use Macready's.

5000 TONS OF BRIGHT STEEL are always available at our main warehouse at Usaspead Corner for immediate delivery. Avoid delays by using the Macready service.

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a tricky job



whichever way you cast it



Half pump casing made from full pattern and without core boxes, weighing 4 tons 12 cwt. cast in Meehanite by G. M. Hay & Company Limited, Glasgow.

Cast Iron Can Do it-if it's

MEEHANITE REGD.

The Dependable Metal

Meehanite Metal Foundries at your service

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. . . yet well within the capabilities of a Meehanite foundry. For Meehanite Iron has all the qualities that such a casting needs—absolute soundness, pressure-tightness, strength, freedom from distortion, and good machinability.

Any of the foundries listed on the left will be glad to send you a free copy of the booklet 'Meehanite in the Service of Industry'.

Meehanite castings can be supplied in any quantity, large or small.

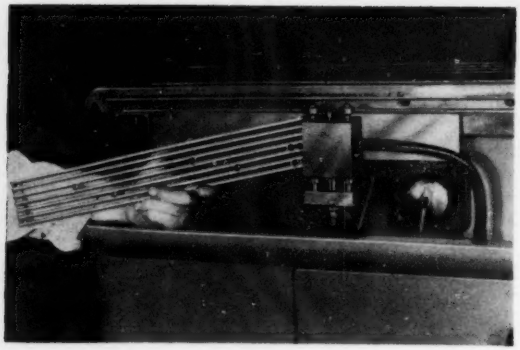
THE INTERNATIONAL MEEHANITE METAL CO. LTD., MEERION HOUSE, 4 DOWNSIDE, EPSOM, SURREY · PHONE: EPSOM 3507-9 · GRAMS: MEERION, EPSOM T.A. 938

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Automatic Milling Machine

Greatest time saver. It is economical on large as well as small batches because the programme plate can be quickly re-set or replaced; it becomes the memory of the machine for future use.

Fully illustrated catalogue on request.

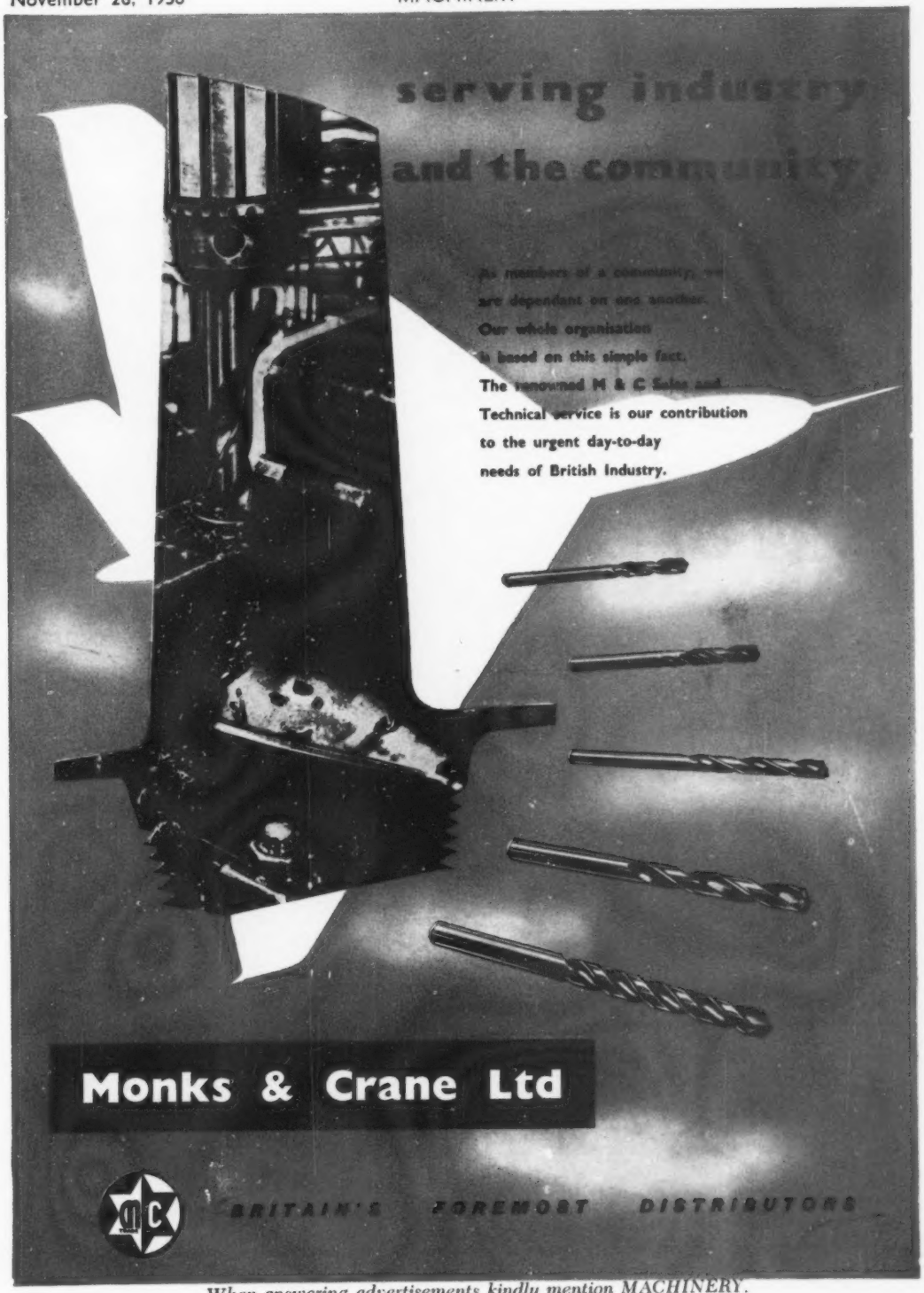




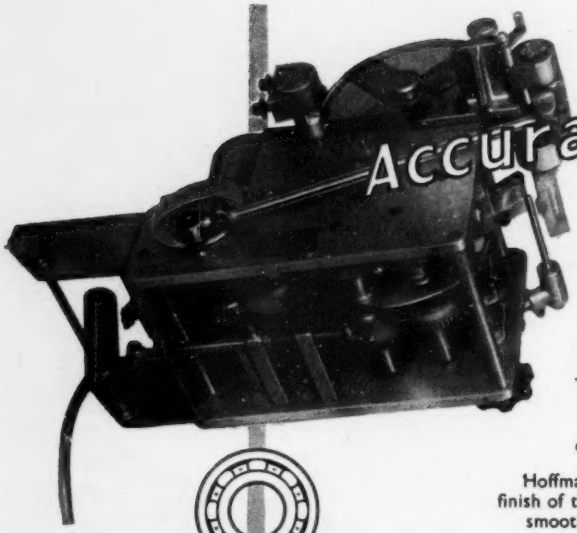
← **THE PROGRAMME PLATE** controls the speed and direction of horizontal and vertical movements alternately.

Production methods and times worked out on receipt of samples and drawings, without commitment.

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Vacuumatic Ltd., of Harwich, are producing a range of ingeniously designed mechanical counting machines doing their work in National Banks, Security Printers and Paper Mills throughout the world.

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Hoffmann Ball Bearings on account of the fine finish of their tracks and rolling elements impart smooth sensitive motion in the counting head as well as on other positions on these machines.

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HEAD CARRIER	FOUR S1 $\frac{3}{4}$" O.D.

You can *Count* on

HOFFMANN

MINIATURE BALL BEARINGS



PUSH ROD LINK	ONE 4666 $\frac{1}{2}$" O.D.



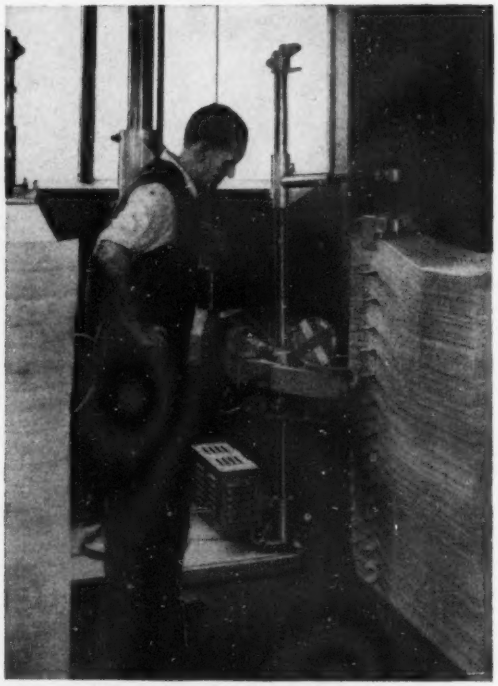
WIPER PIN HOUSING	TWO 86 13 m/m O.D.



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A Vacuumatic Paper Counting Machine in operation.

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DOES A DAY'S WORK BY TEN O'CLOCK

In the day-to-day production of small components many well-known firms using the Harrison 11" Copying Lathe are saving up to 80% of the time previously taken.



11" SWING LATHE
WITH INBUILT COPYING EQUIPMENT

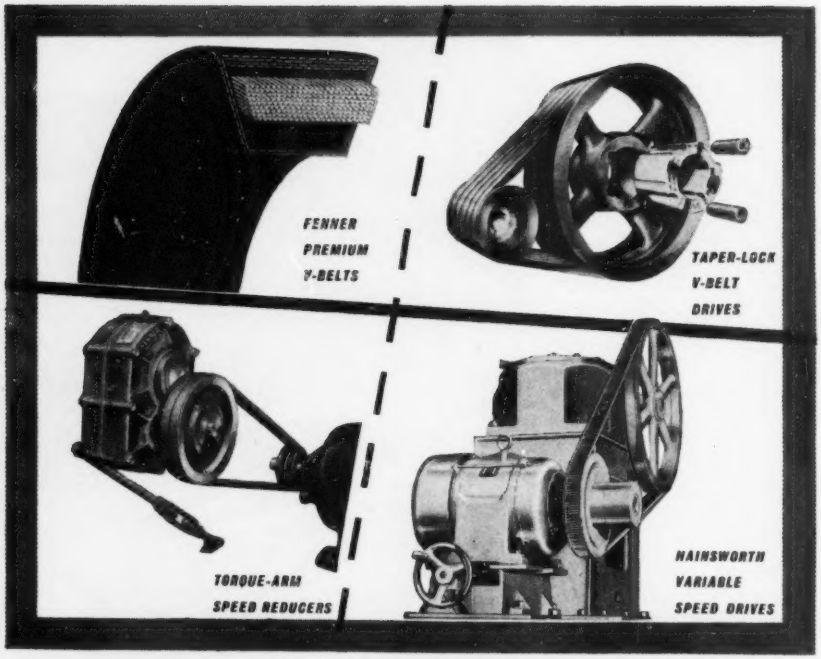
Where large quantities are needed we shall be pleased to submit estimated times if you will send us your drawings and specifications of material to be machined.

Harrison



Copy boring with the Harrison 11" Copying Lathe

T. S. HARRISON & SONS LTD · HECKMONDWIKE · YORKSHIRE



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FENNER
PRODUCTS FOR
RELIABLE
RUNNING

FENNER PREMIUM V-BELTS *save drive cost because fewer are needed and they last much longer. They also have built-in features which withstand heat, resist oil and prevent sparking.*

TAPER-LOCK V-BELT DRIVES *have quick-fixing Taper-Lock bushes which slash installation costs because they go straight from shelf to shaft. Their vice-like grip is also available in chain sprockets, couplings, conveyor drum hubs —and in the new FENAFLEX tyre-type coupling.*

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HAINSWORTH VARIABLE SPEED DRIVES *gives the right speed at low cost, simply by turning a handwheel. The right speed for each job ensures increased production, better quality and greater accuracy.*

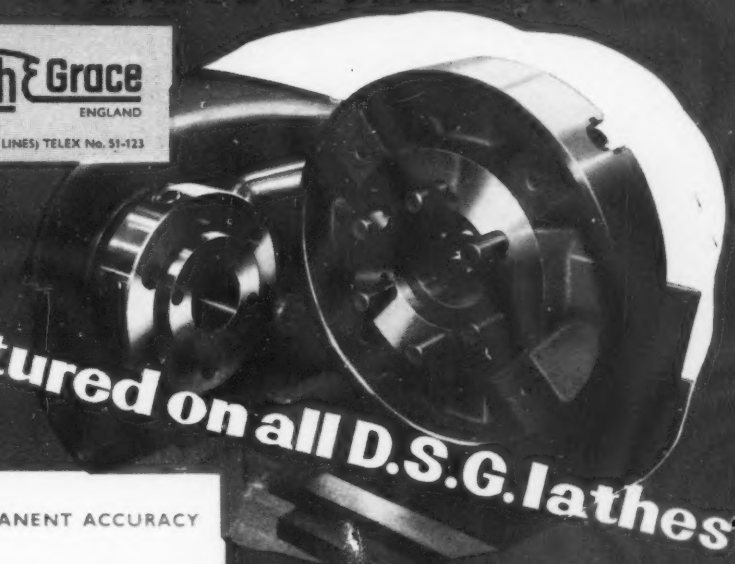
Send for Catalogue 100/18 detailing these products.

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J·H·FENNER
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AMERICAN STANDARD CAMLOCK SPINDLE FLANGE...

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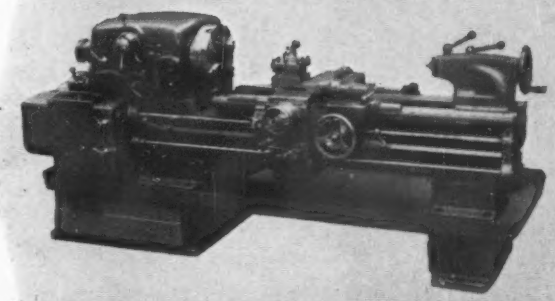
...featured on all D.S.G. lathes

- PERMANENT ACCURACY
- INTERCHANGEABILITY
- RIGID MOUNTING
- RAPID CHANGING

17" swing ENGINE LATHE

Note the spindle bore size, and oversize Camlock flange on these types:

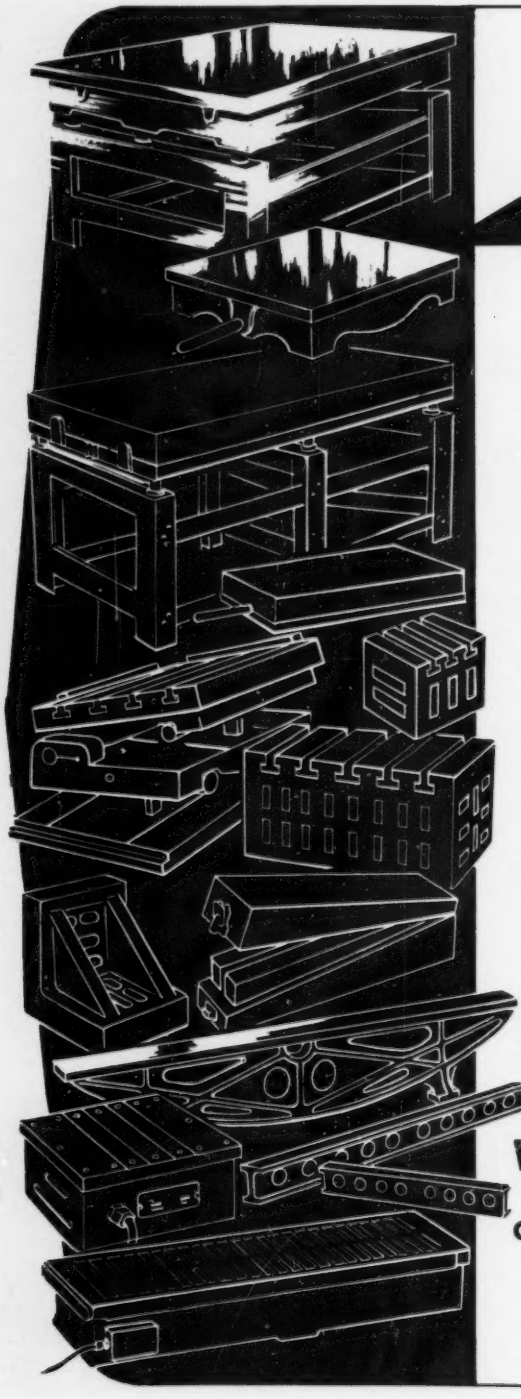
13" swing	D1-6"	1⅛" hole
17" swing	D1-8"	2⅛" hole
21" swing	D1-11"	3⅛" hole
25" swing	D1-11"	4⅛" hole
30" swing	D1-11"	4⅝" hole



We manufacture.... DSG

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SURFACE PLATES AND TABLES. Made from hard close-grained cast iron. Sizes from 6in. by 4in. up to 12ft. 0in. by 6ft. 0in. in Grade "A" and "B" accuracy.

GRANITE SURFACE PLATES AND TABLES. Made from hard close-grained black Swedish granite. Sizes from 8in. by 8in. up to 10ft. 0in. by 5ft. 0in.

SINE TABLES. Simple or Compound Angle types. Supplied with Electro Magnetic, Non-electric Magnetic or "T" slotted work faces. Sizes 8in. by 5in., 10in. by 5in. and 12in. by 8in.

ANGLE PLATES AND BOX ANGLE PLATES. Made from hard close-grained cast iron and rigidly designed for stability. Grade "A" and "B" in all sizes.

STRAIGHT EDGES. Cast Iron Camel Back and "I" Section types from 12in. up to 16ft. 0in.

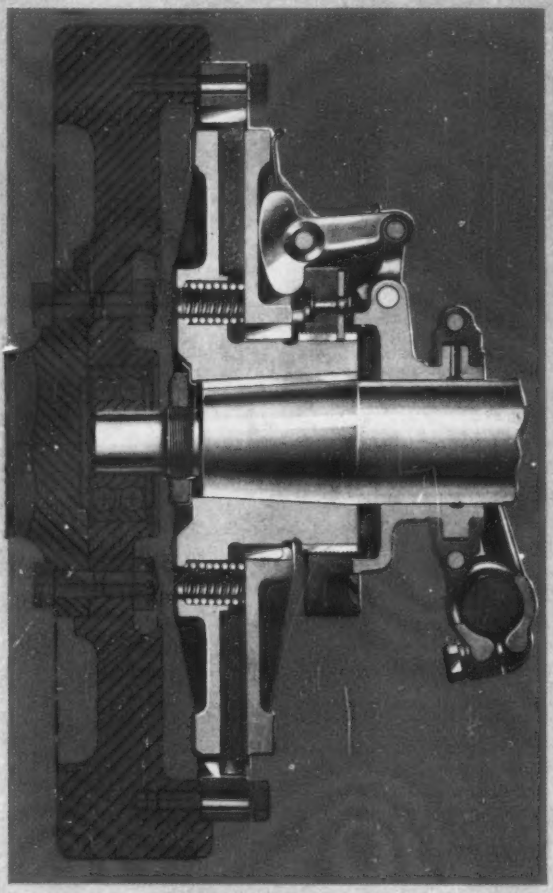
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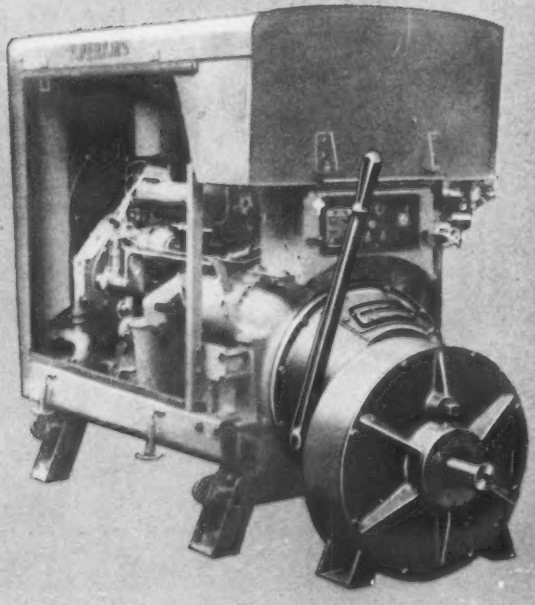
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ROCKFORD

High-duty Clutches & Power Take-offs

Rockford 'over-centre' clutches are expressly designed for use in installations where it may be desirable to run for long periods with the clutch either engaged or disengaged. Their 'over-centre' toggle action is such that there is no running thrust while the clutch is in, or while it is out. The only thrust exerted is during the momentary periods of operation. A wide range of sizes is made, from 5½-in. up to heavy twin-plate clutches, and complete power take-offs are also supplied, comprising housings with the clutch installed.



The illustration shows the Perkins 'L.4' diesel engine, with Rockford 'over-centre' clutch, driving through a Cyril Norris reduction gear, giving a low-speed take-off of value in many industries.

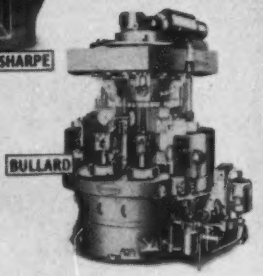
BORG & BECK CLUTCHES, used extensively on cars and commercial vehicles, are made in a wide range of sizes. Particulars of these and Rockford clutches on application.

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Regd. Trade Mark: BORG & BECK

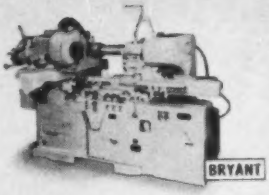
BUSINESS AS USUAL

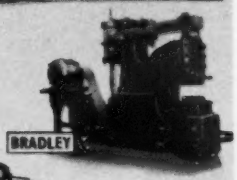
BUCK & HICKMAN LTD



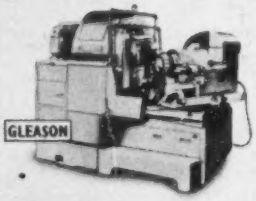
















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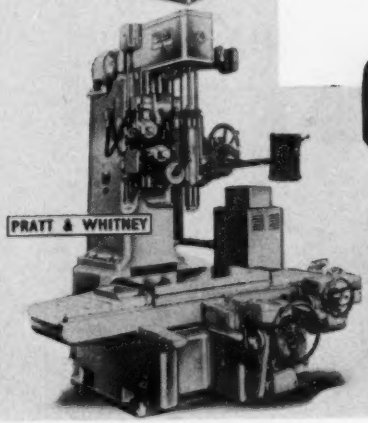
Full details of any machines in which you may be interested will be gladly furnished on request.

BUCK & HICKMAN LTD.

Head Office: Whitechapel Road, London, E.1. Machine Tools, Otterspool Way, Watford by-pass. Branches: Alperton, Bristol, Birmingham, Glasgow, Leeds, Manchester.







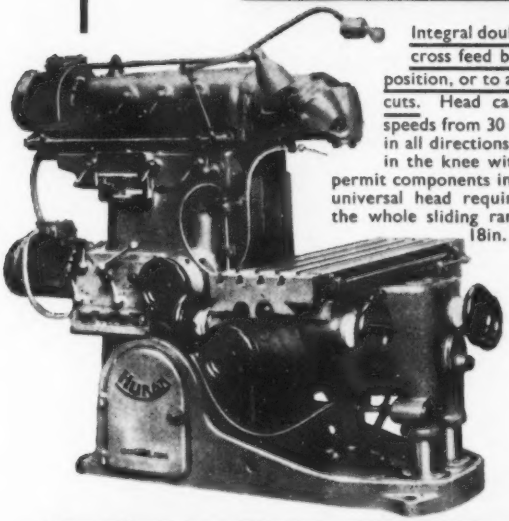
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HEAVY DUTY MILLING

ANGULAR COMPOUND HORIZONTAL VERTICAL

HURON SUPER UNIVERSAL MILLERS

SLIDING RAM GIVES 27½in. AUTO CROSS FEED



Integral double swivelling universal head provided with 27½in. automatic cross feed by the sliding ram, can be set to the horizontal or vertical position, or to any angle instantaneously—permits the heaviest production cuts. Head can be retracted completely from table line. 27 spindle speeds from 30 to 2,066 r.p.m. 27 feeds from $\frac{1}{2}$in. to 30in. Rapid traverses in all directions. All operating controls duplicated. Table slides directly in the knee without cross movement or swivel. Double guides of knee permit components in excess of 1½ tons to be machined. The double swivelling universal head requires an opening of only 14in. to enter work pieces and the whole sliding ram with its 27½in. automatic cross movement needs only 18in. clearance.

Type	Table	Automatic Feeds		
		Long	Cross	Vert.
KU4	56⅞in. × 15½in.	43½in.	27½in.	19⅜in.
KU5	64⅞in. × 15½in.	51½in.	27½in.	19⅜in.
KU6	78½in. × 16½in.	59in.	27½in.	19⅜in.
L7	157in. × 39in.	118in.	27½in.	39⅜in.

Type 'L' Open-side Traversing Head Universal Miller will mill, bore, slot and drill the largest work-pieces at one setting.
The unique design permits greatest variety of operation on large work-pieces; the component remains stationary on the large work-table. Upright slides full length of base table, and the sliding ram moves vertically and horizontally

DUFOUR UNIVERSAL MILLERS

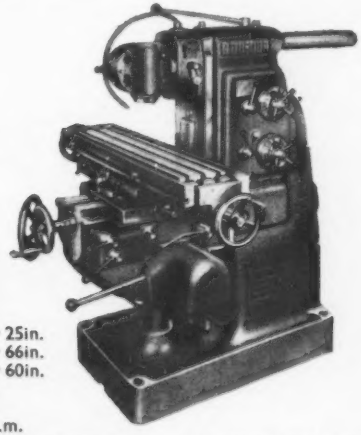
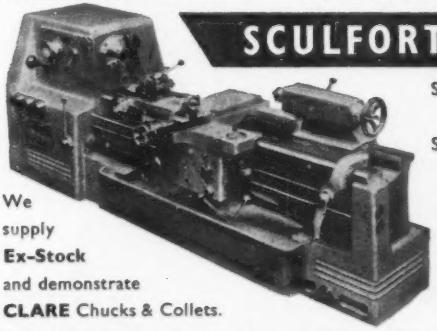


Table surface 43⅝in. by 9⅞in. or 47½in. by 10⅞in. Auto long. feed, 26½in. or 30½in. Auto vert. feed, 15⅜in. or 18⅞in. Auto cross feed 9½. Rapid traverse in all directions. No. 40 International taper for main spindle, universal head, and rotary table. Direct reading dial change for speeds and feeds. All parts subject to wear hardened and ground and completely interchangeable. Built to closest tolerances. Spindle speeds 21 to 1,600 r.p.m. Twin overarms. Separate motor for rapid traverses.

Also table 63in. by 15in., with auto feeds: 40in. long., 21in. vert., 14in. cross; 25in. auto-univ. head feed. 36 spindle speeds 6 to 1,500 r.p.m.

SCULFORT LATHES



We supply **Ex-Stock** and demonstrate **CLARE** Chucks & Collets.

Swing over bed 20, 22 or 25in.
and 28, 32 or 66in.
and 40, 47 or 60in.
Speed ranges: 6-2,000;
12-1,600;
or 3½-325 r.p.m.

18-45 h.p. motor drives for max. output. Totally enlcosed gear box provides 90 different pitches. Flame hardened bed. Large spindle bore. All head stock gears hardened and ground. Built-in coarse screw cutting device.

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Telephone: CHISWICK 0514 & 6585. Inland Telegrams: RUDCAR, CHISK, LONDON. Overseas Telegrams: RUDCAR, LONDON.

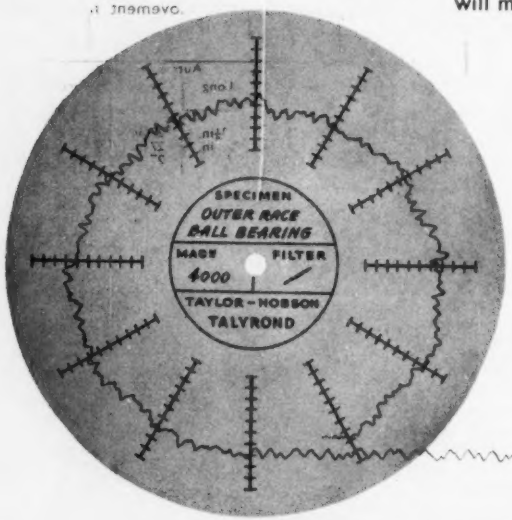
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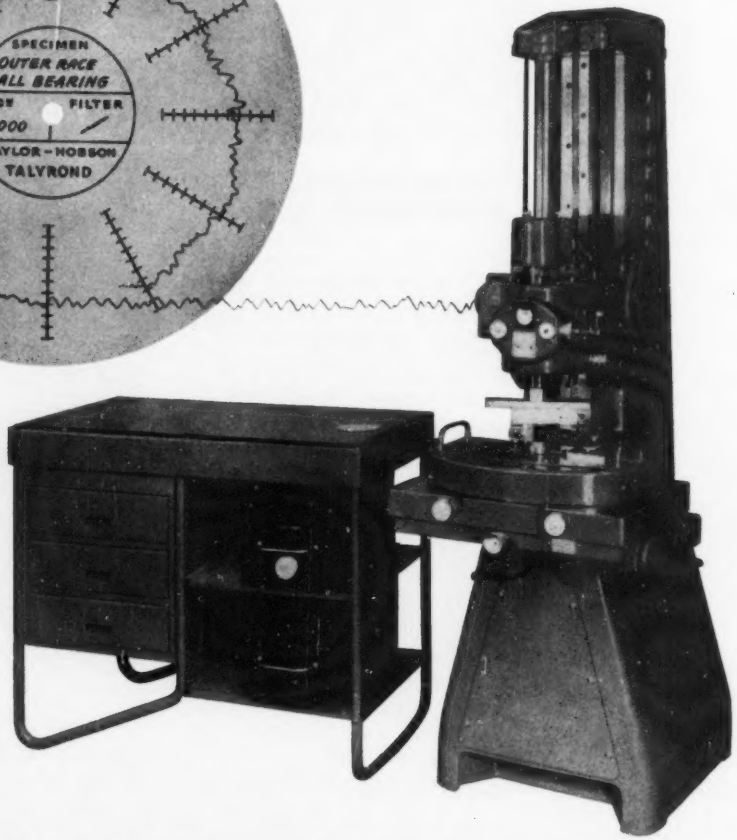
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ROUNDNESS MEASURING INSTRUMENT

Smoother, quieter for faster running.

Roundness is the key to smoother, quieter faster running, and such qualities depend upon the correct geometric shape as well as dimensional accuracy. The Taylor-Hobson 'Talyrond' Roundness Measuring Instrument will measure errors as infinitesimal as 3 micro-inches (·000,003-ins.), thus assisting in the analysis of manufacturing processes leading to optimum performance.





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This 'LASCO' operates as a 300 ton press, or 7-ton gravity drop-stamp.

Self-contained, infinitely variable speeds and pressures of ram and drawing cushion.

Instantaneous in action.

Range from 75 tons upwards.

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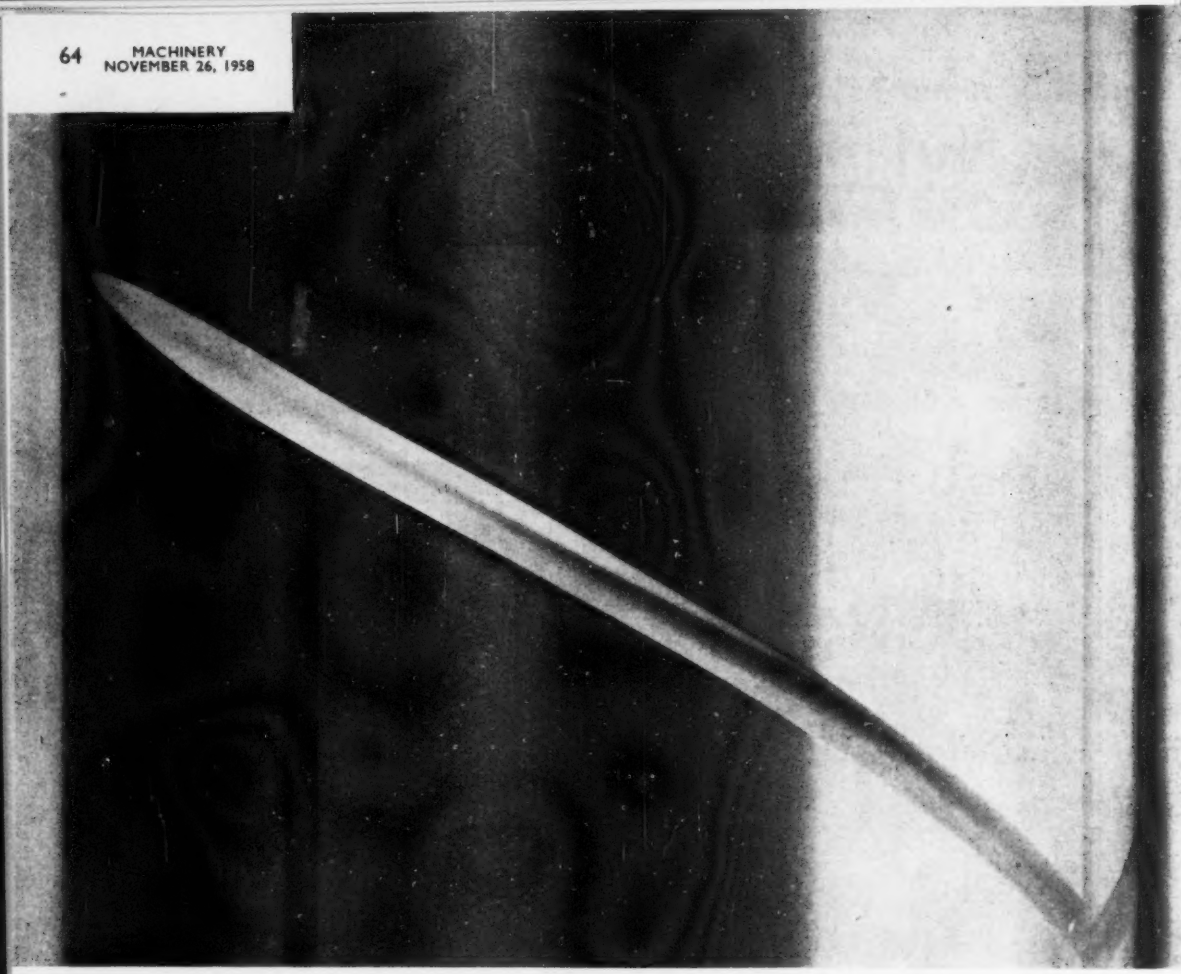
39, VICTORIA STREET, LONDON, S.W.1.

Tel.: ABBEY 5338 'Grams: POWAFORGE, SOWEST, LONDON. Cables: POWERFORGE, LONDON

NRP71

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SUPERFINISH...

modern preventive for metal "skin wounds"!

This *unretouched* enlargement shows the surface of a spindle quill—ground and chrome plated. It was scored and damaged as the machine was jarred in shipment. Had the part been Superfinished *before* plating, the soft underlying "smear metal" caused by grinding heat would have been removed, leaving a hard surface far less susceptible to such "skin wounds".

Superfinishing is a real economy wherever maximum bearing life is desired. Write to our agents for full information about GISHOLT British Built Superfinishers.



THE GISHOLT ROUND TABLE *represents the collective experience of specialists in machining, surface-finishing and balancing of round and partly round parts. Your problems are welcomed here.*

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A Subsidiary of the Gisholt Machine Company, Madison, U.S.A.

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MODEL 15AX CAM FEED, AUTO TABLE TOOLED UP FOR AUTOMATIC PRODUCTION ON CURTAIN RAIL FITTINGS

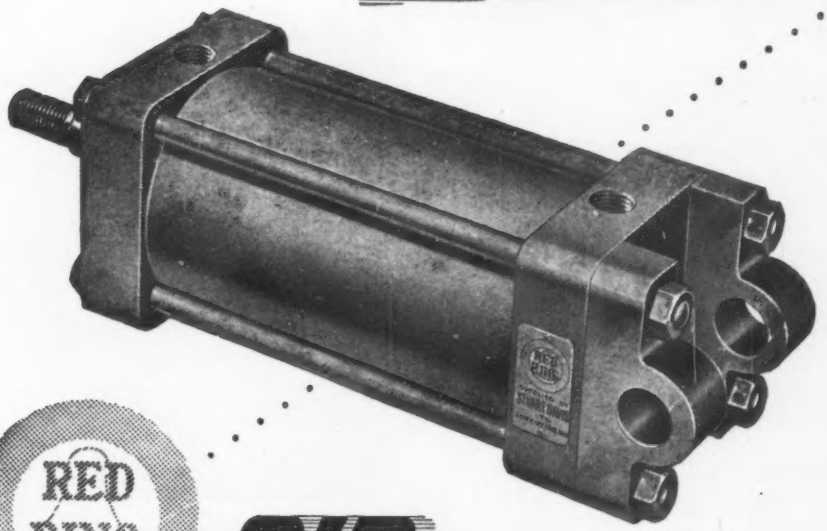
This machine with cam-feed, has a six-spindle vertical head for drilling and tapping, as well as a side unit with a two-spindle head. The mechanical revolving table has six stations and two components are loaded at each station. Parts are drilled and tapped vertically and horizontally and all operations are performed simultaneously. Except for loading, operation is entirely automatic. Production 750 per hour.
(Splash guards removed for purpose of illustration.)

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RED RING AIR CYLINDERS & VALVES

Are you sure your engineers have appreciated the economies to be made by using properly controlled air power ?

For Pushing or Pulling—Lifting or Lowering—Opening and Closing—Tilting or Turning, RED RING Air Cylinders and Valves provide flexible fluid power at low cost. From a simple single cylinder controlled by a hand valve to the most complicated circuit of interconnected cylinders and automatic valves working in timed sequence, air will provide the cheapest aid to great productivity.

RED RING Range of cylinders and control valves offer quality at really competitive prices.

Send for your comprehensive catalogue—NOW and call in our Technical Department for free advice.

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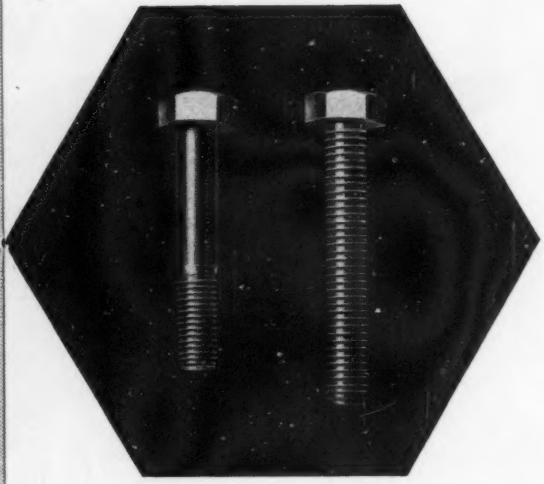
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COLD HEADED BOLTS & SETSCREWS

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Why look elsewhere, when all the benefits of long specialization plus the closest adherence to exacting quality standards, are yours when you decide it's "ORMOND" for Cold Headed Bolts and Setscrews.

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AUTOMATION

LIPE *Automatic* Magazine Loading BAR FEED

Averages Net Gain of 78% in running time!



Another Record

THE JOB . . . At a typewriter plant, such operations as cut-off, chamfering, shaping ends, knurling were done on fourteen different jobs, ranging in length from 5¼in. to 16¼in. A Model OO B & S Screw Machine having a Lipe Automatic Magazine Loading Bar Feed attached was used.

THE RESULTS . . . On running time alone, a net gain of 78% was averaged over the fourteen separate jobs. And that's not all! A minimum of 30% was also gained in production because the screw machine does not "cut air" when it is left running unattended by the operator. Therefore, the overall result on these widely varied jobs, is an average increase in total production of 108%.

BIG Production Gains- on a great variety of work Because . . .

- Stock is fed to screw machine all the time —not dependent on operator
- Feed-out pressure always behind stock
- Eliminates feed fingers
- Avoids multiple feed finger feed-outs
- Model AML gives maximum output of machine —no "cutting air"
- Saves in change-over set-up time

Patent Nos. 728898 and 743461
Infringement will be prosecuted

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there are several variations

on TWELVE BASIC TYPES

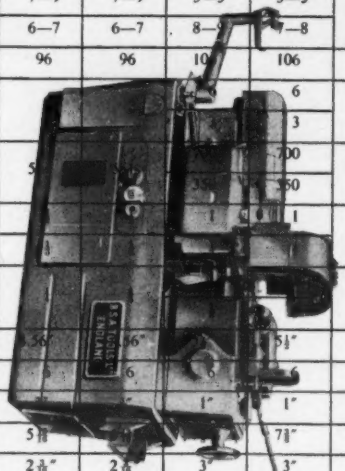
capacities up to 2" or 52mm (round)

this wide range

of single-spindle automatics

is offered by—

B.S.A

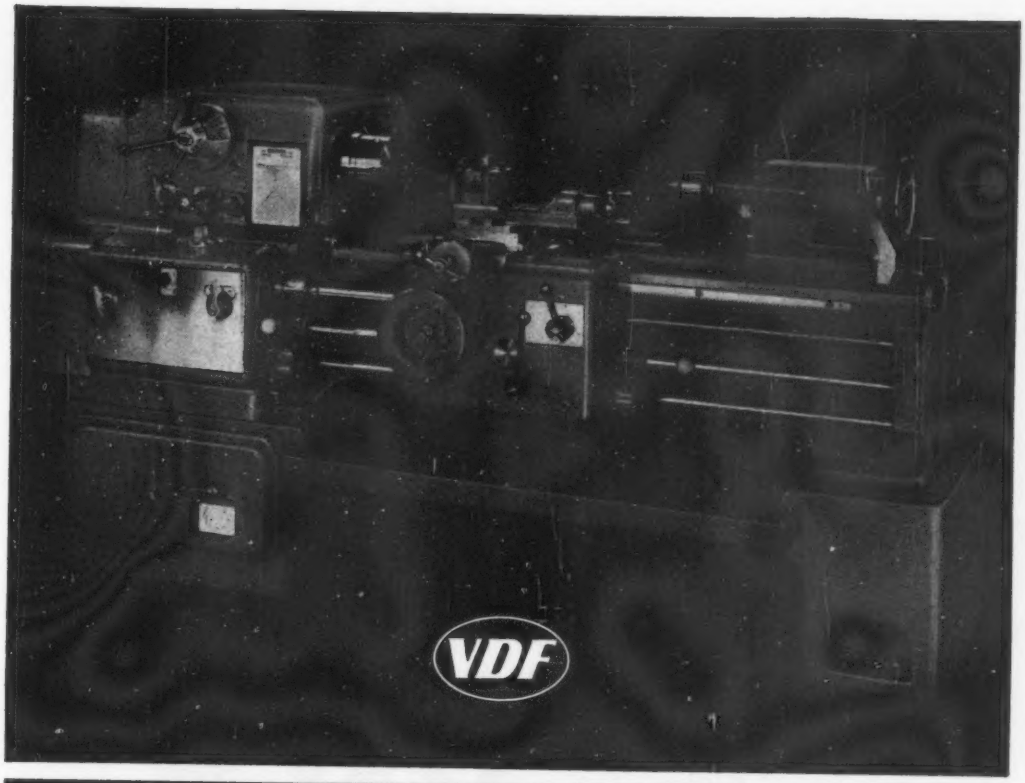


MACHINE		48	68	18L	25L	68L	88L	98L	138L	168L	METRIC 24	METRIC 36	METRIC 52
Workspindle capacity	round	½"	⅝"	18 mm.	25 mm.	⅜"	1"	1⅛"	1⅜"	2"	24 mm.	36 mm.	52 mm.
	square	.353"	½"	13 mm.	18 mm.	.0530"	.0708"	11/16"	1¼"	1.414"	17 mm.	25.4 mm.	35 mm.
	hexagon	.437"	⅝"	16 mm.	22 mm.	0.650"	0.866"	⅞"	1⅛"	1.730"	20 mm.	30 mm.	45 mm.
Max feed in one movement	long stroke	2"	3"	75 mm.	75 mm.	3"	3"	4"	4"	4"	90 mm.	90 mm.	90 mm.
	short stroke	1"	2"			2"		2½"	2½"				
Stroke of turret cam (standard)		1¾"	2½"	50 mm.	50 mm.	2½"	2½	3"	3"	3"	80 mm.	80 mm.	80 mm.
Max. diameter using diehead		⅜" fine	½" fine	16 mm.	16 mm.	⅝" fine	⅝" fine	1"	1¼"	1¼"	18 mm.	18 mm.	18 mm.
Range of spindle speeds		166—7,370	53—4,480	40—4,500	40—4,500	53—4,480	53—4,480	70—3490 24—3590	78—2300 25—2540	69—1,520	38—3,000	24—1,900	30—1,500
Number of high speeds	4 speed	18	10	14	14	10	10	22	19	17	10	10	8
	2 speed			14	14	10	10	13	12				
Low speeds available for each high speed		2	10	11—13 9—10	11—13 9—10	7—9 6—7	7—9 6—7	3—5 8—	3—5 7—8	3—5	4—5	4—5	4—5
Number of cycle times		46	65	96	96	96	96	10	106	106	46	46	46
Cycle time range (secs) fastest	long stroke	¾	2	2	2				6	6	8	8	8
	short stroke	¾							3				
slowest	long stroke	75	180	561	561	5			00	700	360	360	360
	short stroke	56½							60				
Actual time to feed stock (secs)	long stroke	½	½	½	½				1	1	1	1	1
	short stroke	¼	¼										
Time to change speed (secs)	long stroke	½	½	½	½					½	½	½	½
	short stroke	¼	¼										
Diameter of turret		3½"	4 1/16	116 mm.	116 mm.				5½"	5¼"	140 mm.	140 mm.	140 mm.
Number of turret holes		6	6	6	6				6	6	6	6	6
Diameter of turret holes		⅜"	½"	19.05 mm.	19.05 mm.			1"	1"	1"	25.4 mm.	25.4 mm.	25.4 mm.
Distance chuck to turre	max.	3½"	5⅛"	120 mm.	120 mm.	5 1/8			7⅛"	7⅛"	180 mm.	180 mm.	180 mm.
	min.	1 11/16"	2½"	49 mm.	49 mm.	2 1/16"	2 1/16	3"	3"	3"	64 mm.	64 mm.	64 mm.
Turret slide adjustment		5/16"	⅜"	21 mm.	21 mm.	1 5/16"	1 5/16"	1¼"	1¼"	1¼"	38.1 mm.	38.1 mm.	38.1 mm.
Spindle centre to top of cr	slide	1"	1 1/16"	30 mm.	30 mm.	1 3/16"	1 3/16"	1 1/16"	1 1/16"	1 7/16"	36 mm.	36 mm.	36 mm.
Movement of cross slide		1"	1¼"	32 mm.	32 mm.	1¼"	1¼"	1¾"	1¾"	1¾"	40 mm.	40 mm.	40 mm.

MAKERS B.S.A. TOOLS LTD · BIRMINGHAM 33 · ENGLAND

AGENTS U.K. BURTON GRIFFITHS & CO LTD · KITTS GREEN · BIRMINGHAM · STECHFORD 3071

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- extremely versatile, with a high degree of finish.
- up to 30 spindle speeds from 11 to 2240 r.p.m.
- smooth, even transmission and control at all speeds.
- large base area and box section construction ensures exceptional rigidity.
- six models available.
- a wealth of additional equipment is offered.
- fully descriptive literature on request.

BRIEF SPECIFICATION

	Type 36	Type 44
swing over bed	15¼"	18"
centre distances	29½"	30½"
height of centres	7¼"	9"
main spindle bore	2"	2"
no. of speeds	18 or 30	18 or 30
speeds—r.p.m.	11-2240	11-2240

Sole British Agents

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Machine Tool Co. Ltd

Hythe Works, The Hythe
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Staines 5076 (3 lines)
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HAVE YOU ANY REALLY TOUGH TAPPING PROBLEMS IN HIGH TENSILE STEELS?

A NEW MANUFACTURING PROCESS IS GIVING AMAZING RESULTS AND MUCH LONGER TAP LIFE ON THESE DIFFICULT MATERIALS

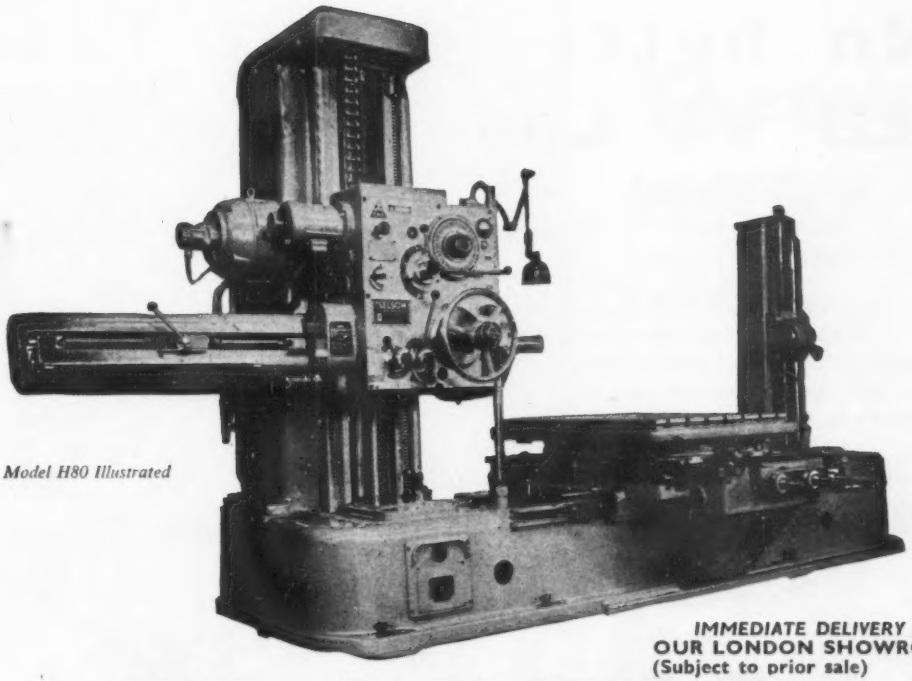
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Model H80 Illustrated

IMMEDIATE DELIVERY FROM OUR LONDON SHOWROOMS
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PLAUERT

HORIZONTAL BORING and FACING MACHINES

Safety Clutch disengages automatically working feed or rapid traverse to prevent damage. Power feed to table (Longitudinal, Cross and Circular) • Push Buttons allow fine adjustment of Spindle or Faceplate when setting • Automatic cross feed to facing head • Designed and built for Precision Boring, Drilling, Milling, Threading, Reaming and Facing • Enduring accuracy • High productive ability • Wide speed and feed range • Ease of operation.

Models H80 and H100 are arranged with electric preselection of spindle speeds and feeds.

Sole Agents

Selson MACHINE TOOLS

BRIEF SPECIFICATION

Model	H63	H80	H100
Diameter of Spindle	2¼"	3⅛"	3⅜"
Max. diameter for facing	22"	28"	35½"
Working surface of table (width x length)...	28" x 35½"	35½" x 44½"	44½" x 49½"
Number of spindle speeds	16	18	27
Range of spindle speeds: r.p.m.	8—1400	5.6—1000	2.8—710

The Selson Machine Tool Co. Ltd

41-45 MINERVA ROAD, NORTH ACTON, LONDON, N.W.10

Telephone: Elgar 4000 (10 lines) Telegrams: Selsomach, London, N.W.10

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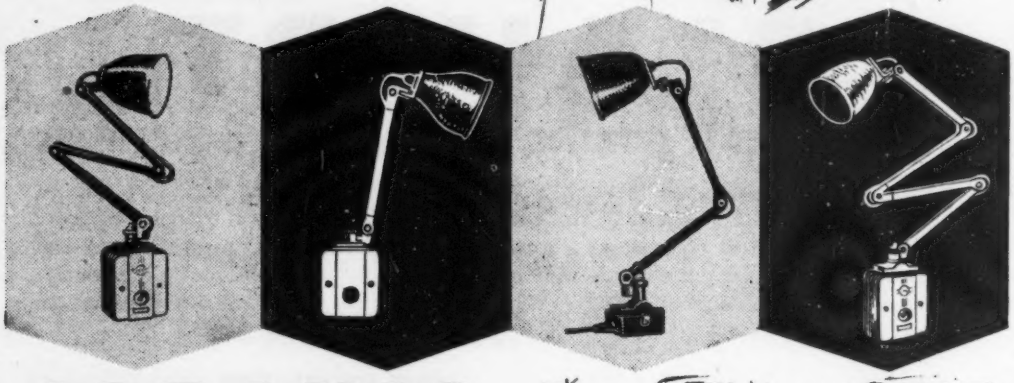
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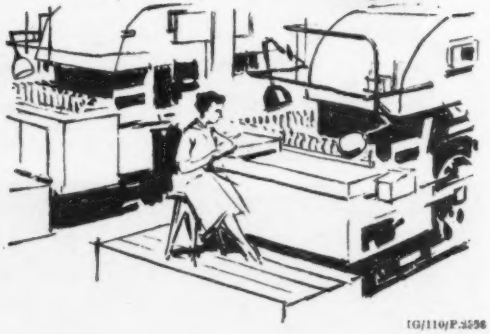
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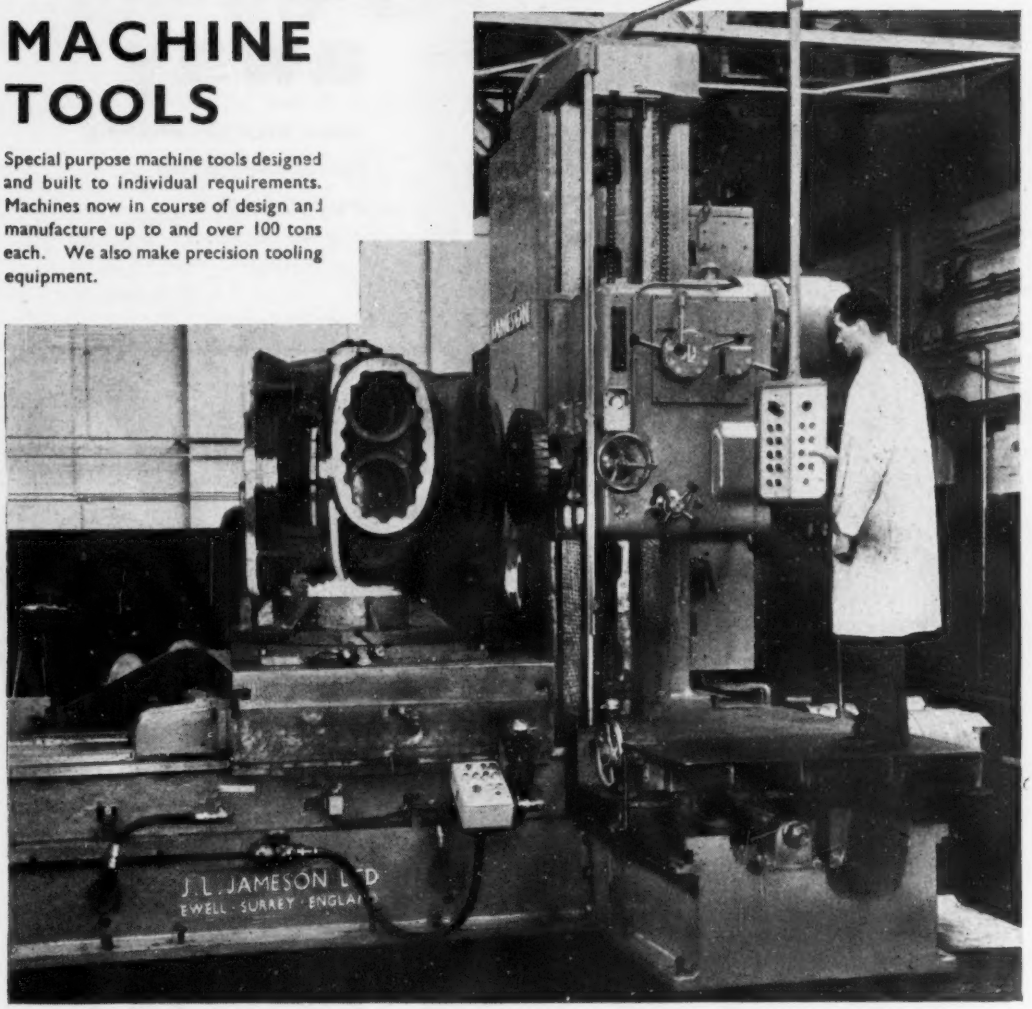
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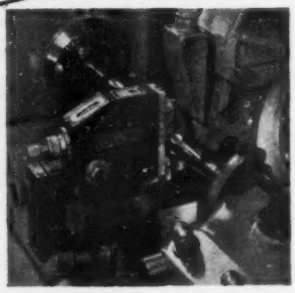
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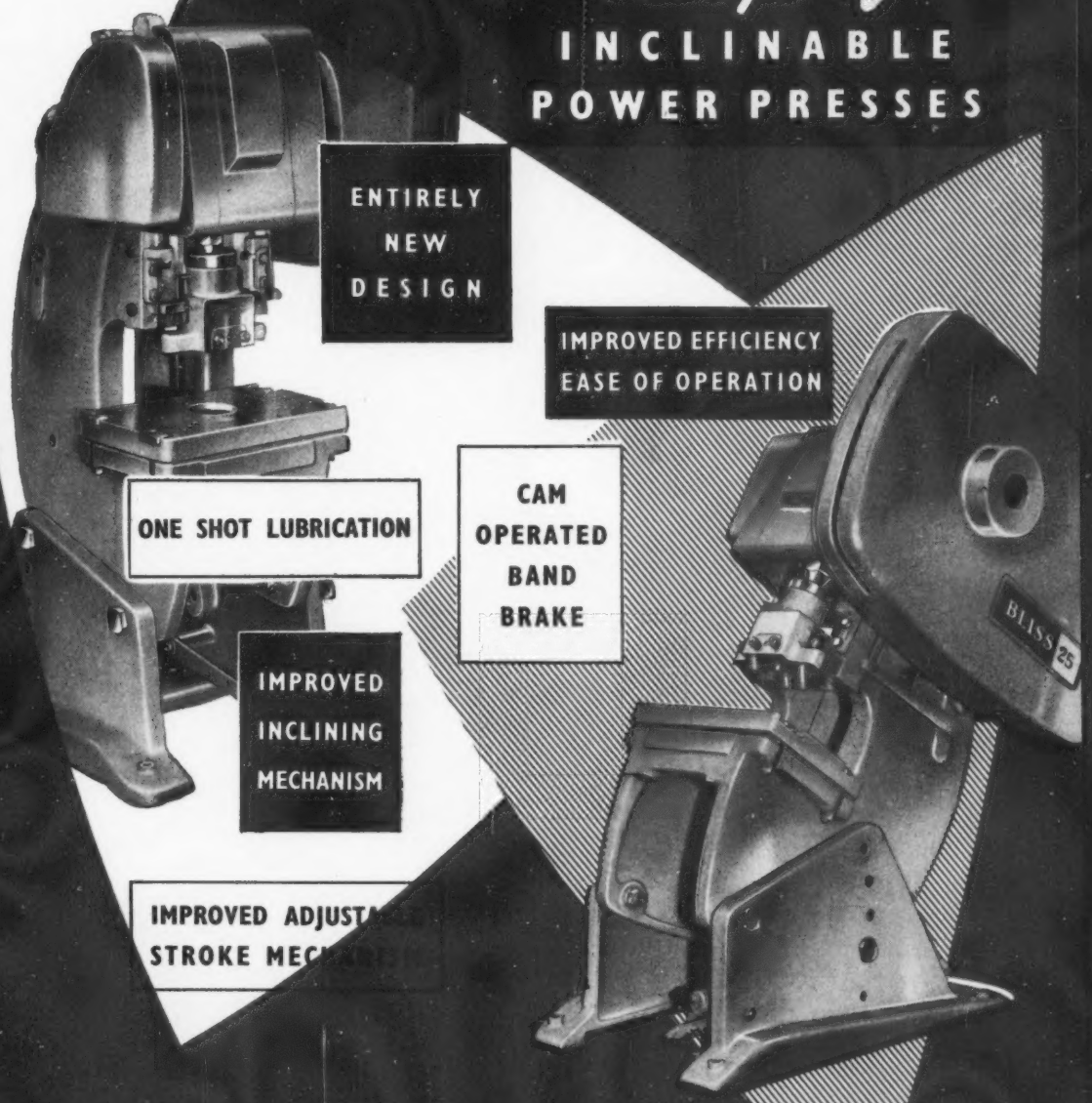
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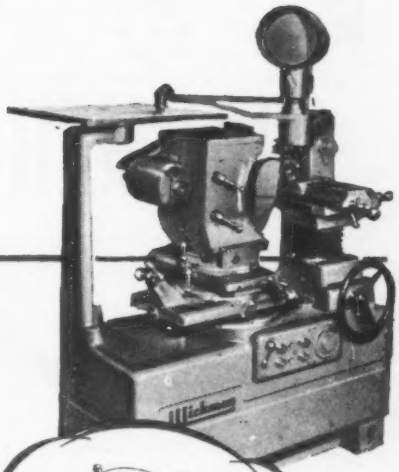
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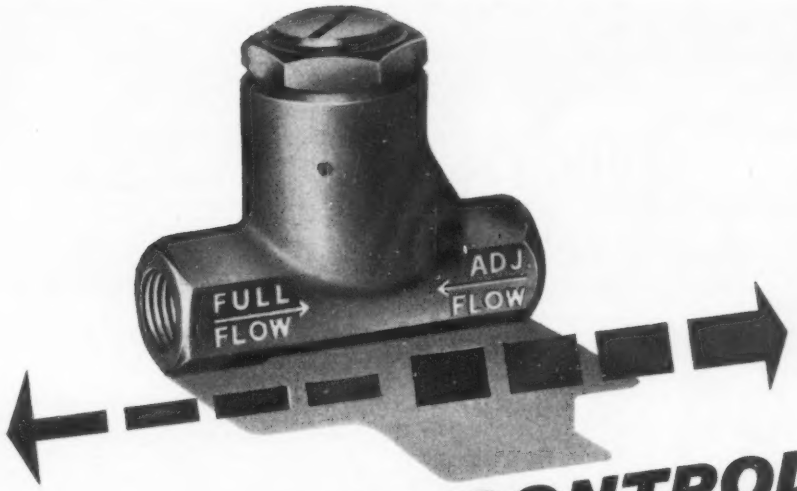


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Non-corrodible plunger assembly, replaceable in one unit.
Substantial lock-nut resists vibration.

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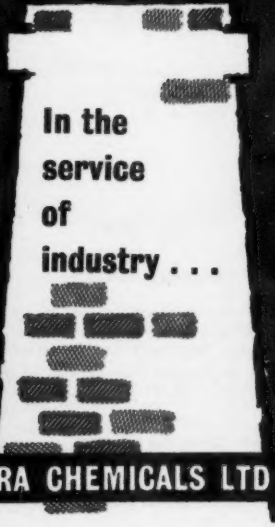
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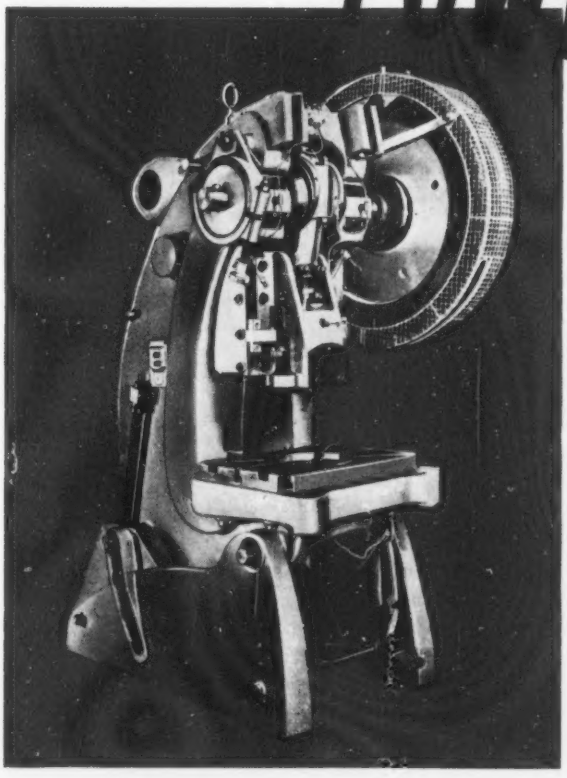
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Advanced in performance
Clutch virtually indestructible
POWER PRESS

MADE IN ENGLAND

40-TON PRESS



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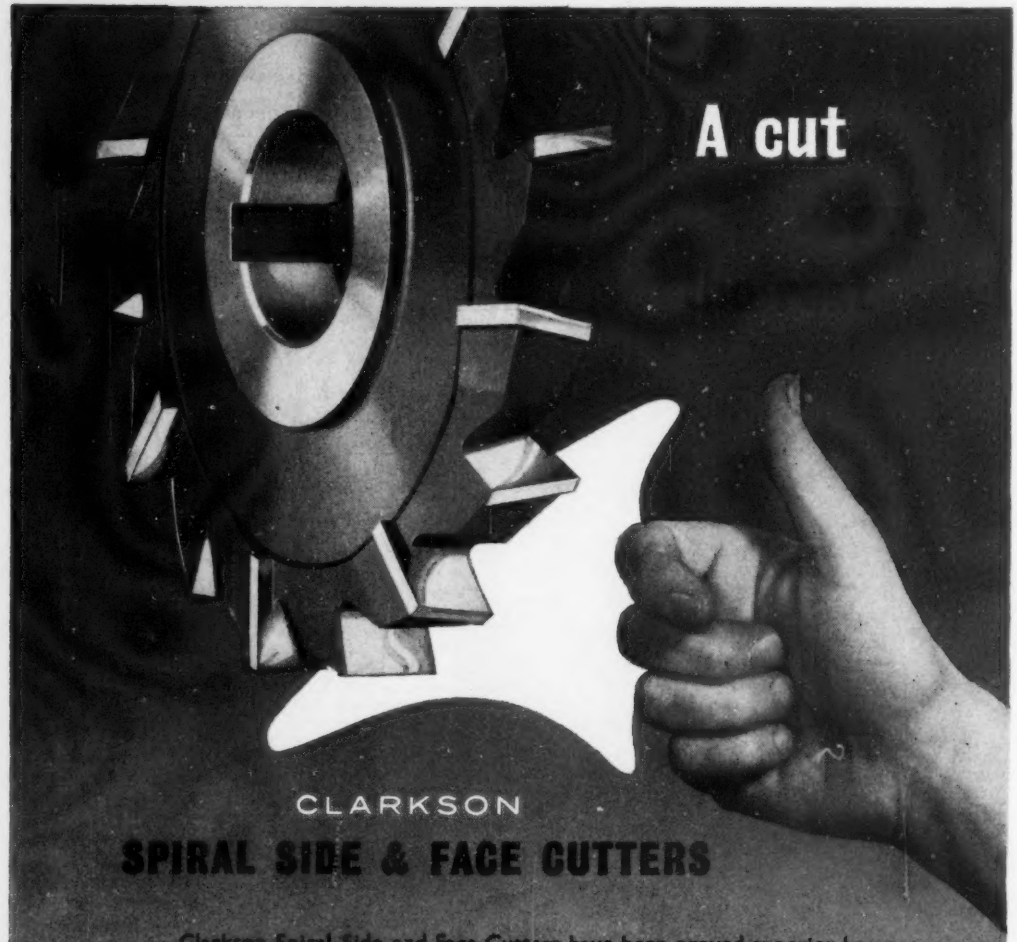
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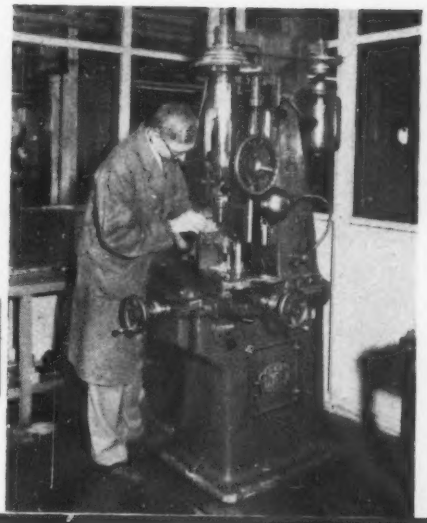
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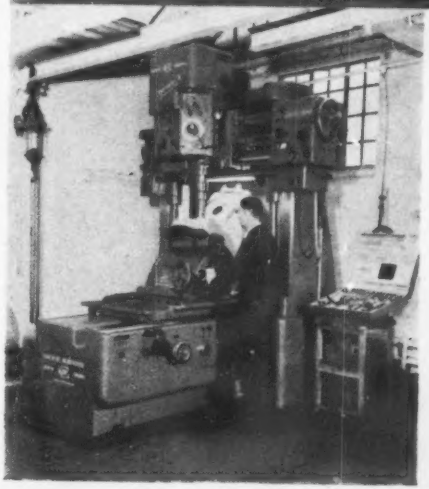
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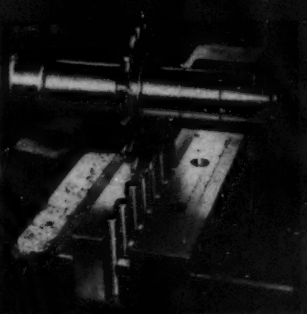
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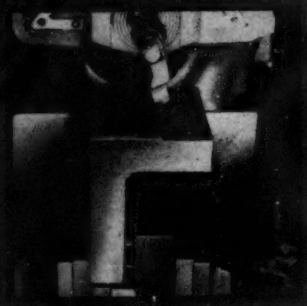
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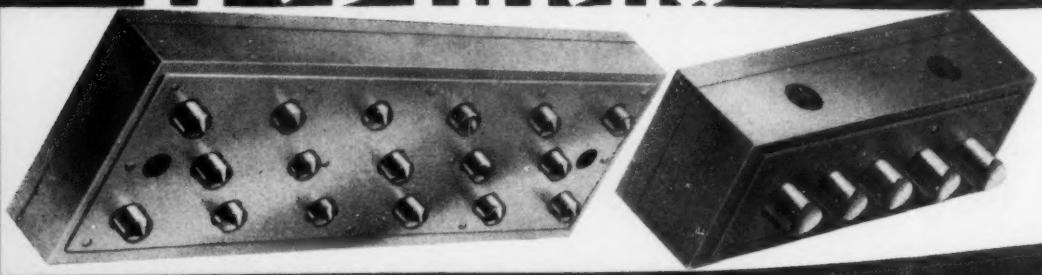
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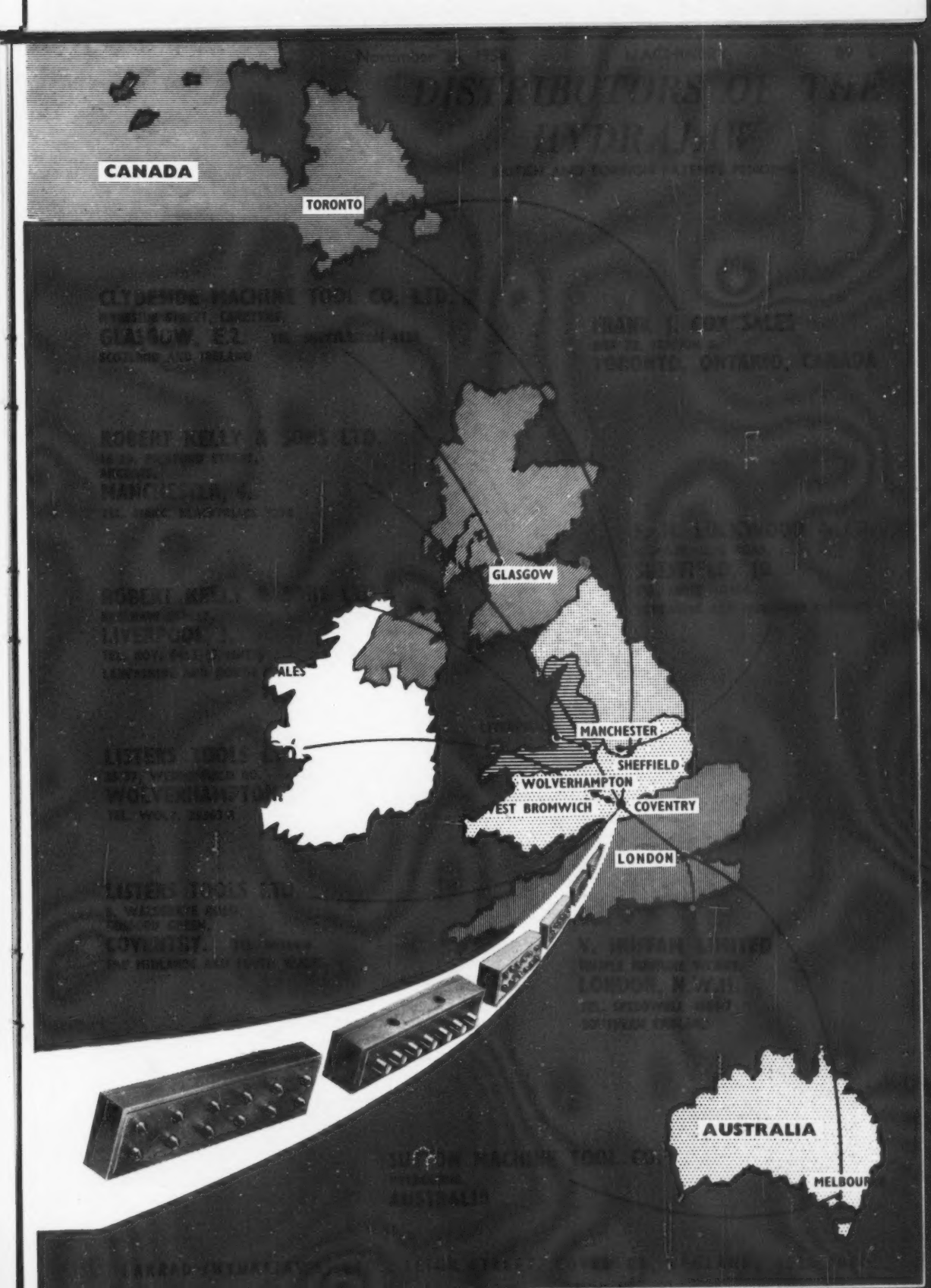
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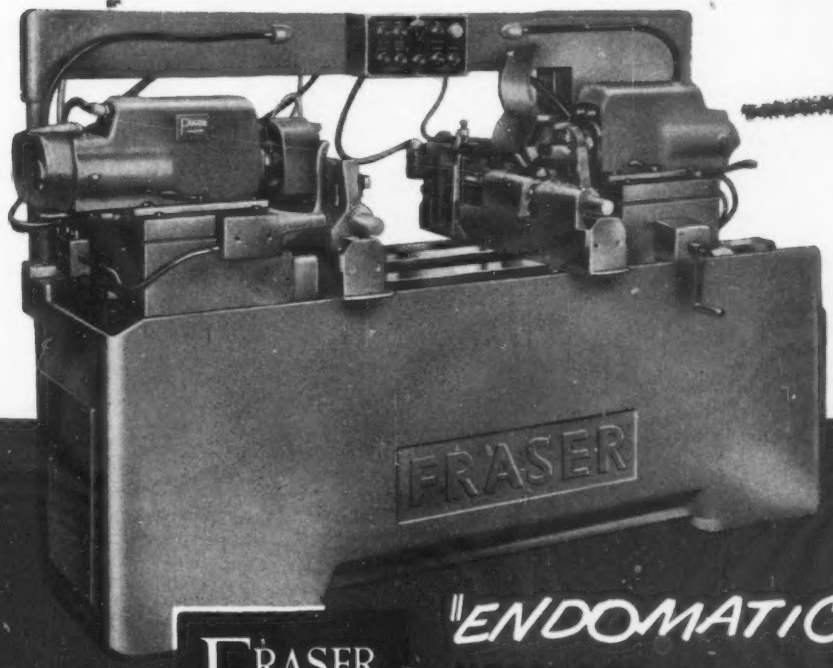
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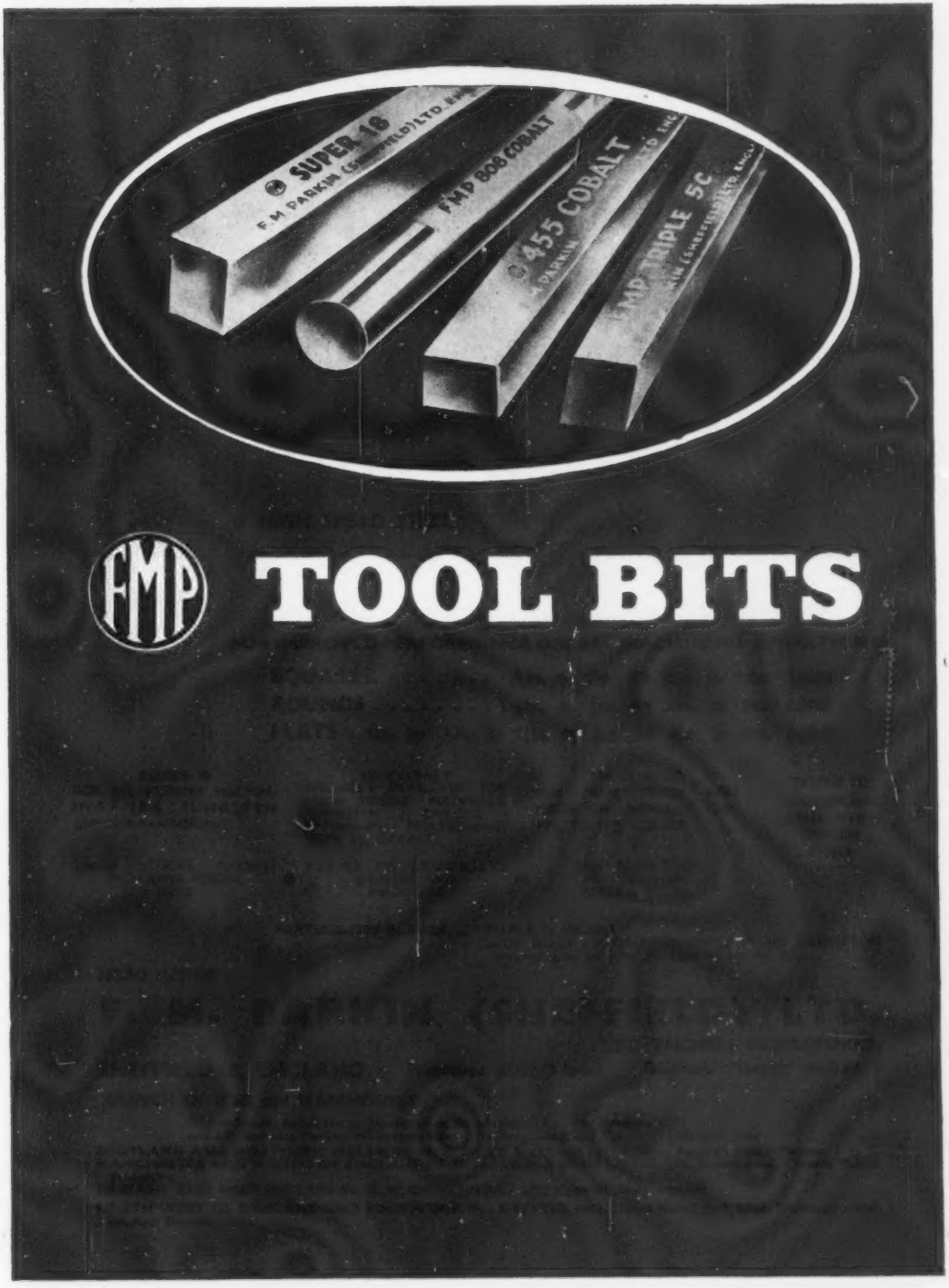
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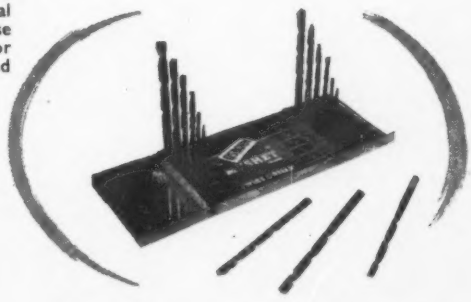
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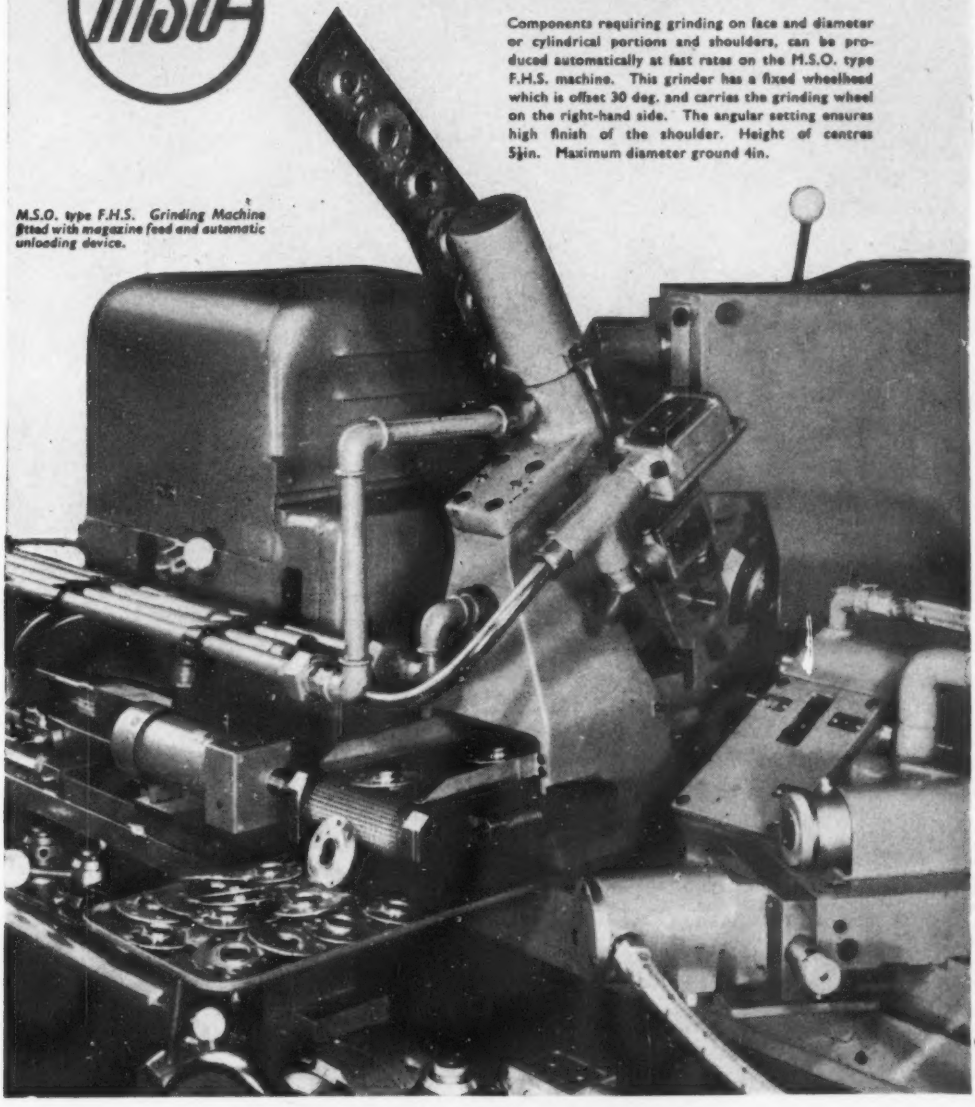
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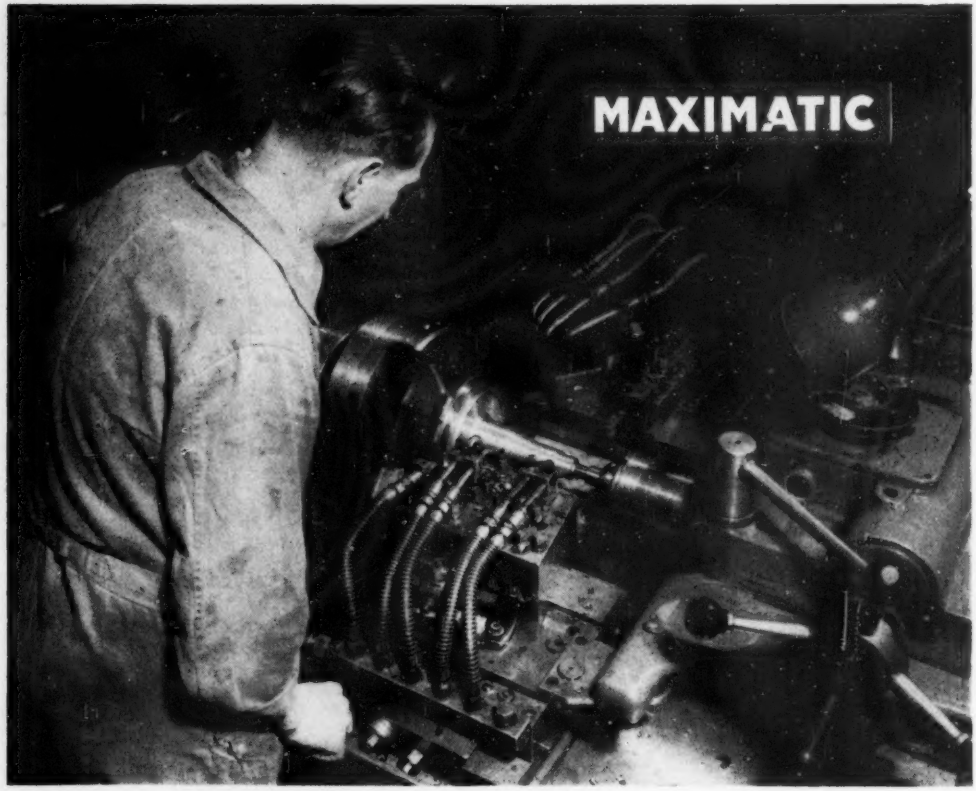


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Abstracts of Principal Articles

Producing the Vauxhall Victor.....P. 1212

In this article, the machining of hypoid pinion blanks from forgings for the rear axle of the Vauxhall Victor car is first discussed, one of the more interesting operations being carried out on an H.E.B. hydraulic copying lathe, provided with completely automatic loading, unloading and gauging equipment. On this machine, the shaft, with the ends faced and centre-drilled, is finish-turned from the rough forging in a cycle time of 70 sec. At subsequent stages, two bearing diameters are ground, and the hypoid teeth, driving serrations, and a thread are cut. Special machines for assembly operations on axle shafts are next described, the first being a hydraulic press for inserting the four wheel studs into the flange holes and peening them in place. The other machine presses the outer shaft bearing and a retaining ring into place on the axle shaft, after the ring has been induction heated to provide for a shrink fit. The pinion-shaft bearings are pre-loaded, during assembly, by the controlled tightening of the flange-retaining nut on an automatic machine which measures the torque transmitted through the bearings. Another special rig is employed for the fitting of the differential sub-assembly to ensure that the required degree of backlash is obtained between the teeth of the wheel and the pinion. A special air gauging unit on this rig measures the thickness of the spacer required at one end of the axle housing to give the required degree of pre-loading for the effective functioning of the axle assembly. (MACHINERY, 93—26/11/58.)

Combined Research to Improve the Performance of Multi-spindle Automatics P. 1223

If the optimum performance is to be obtained from a multi-spindle automatic, special attention must be paid to the quality of the machine, bar stock, cutting tools and holders, measurement-control equipment, coolant and lubrication. To promote the necessary standards of quality and collaboration between the various suppliers, a co-operative, non-profit making research project has been undertaken by a group in the U.S.A. For this purpose the Cone Automatic Machine Co. have set up an enclosed "Comapro" department, where trials can be carried out under controlled conditions. The first component which is being investigated is a sparking plug shell and the equipment employed, and some results already obtained are considered in this article. It may be noted that pre-set quick-change holders are employed, and that nine tools can be removed and replaced in 5 min. 40 sec. (MACHINERY, 93—26/11/58.)

Jackson & Bradwell Direct Indicating Static and Dynamic Balancing Machines ...P. 1230

Jackson & Bradwell, Ltd., Grove House, Sutton New Road, Birmingham 23, have recently introduced fully-automatic, direct indicating versions of their electronic vertical and horizontal dynamic balancing machines. On both types of machines, indications of the amount and position of unbalance are given on dial-type instruments, and the readings are "locked" when the machine stops at the end of the cycle. The latter includes a running dwell period, controlled by an adjustable timer, to ensure stabilization of the readings before they are locked. Vertical machines are intended for balancing disc-shaped components such as flywheels in one plane only, whereas the horizontal machines provide for items requiring correction in two planes. In the horizontal type, separate "amount" and "position" instruments are provided for each correction plane, and the machine switches automatically from one plane to the other. The simple calibrating procedure is also described. (MACHINERY, 93—26/11/58.)

Die Casting Electrical Components...P. 1245

An extremely versatile die casting foundry is operated at the Manchester factory of Metropolitan-Vickers Electrical Co., Ltd., and castings are produced in zinc, aluminium, brass and aluminium-bronze alloys, by gravity, hot- and cold- chamber, and low-pressure processes. The layout of the foundry and the adjacent fettling shop is here described, and reference is made to the equipment installed, the alloys cast, and certain details of die construction for brass and aluminium bronze alloys. Some of the more interesting brass castings made by the conventional cold-chamber casting process and the low-pressure process are then briefly discussed, and some particulars are given of the dies in which certain of these castings are produced. The casting required in the largest quantities is a brass terminal block, which is made in a four-cavity die at the rate of about 8,000 per week, two dies being provided to ensure continuity of production. Dies for brush-holder and bracket castings, also for a casting incorporating two brass stud inserts, are also described. Some details are then given of the low-pressure process, for which a vertical air cylinder is employed to inject the molten metal into the die cavity. Finally, some parts which were formerly made by sand casting are compared with their die cast equivalents. (MACHINERY, 93—26/11/58.)

Producing Type Sectors for Calculating Machines ..... P. 1255

Type sectors for calculating machines built by the Victor Adding Machine Co., U.S.A., consist of a blank, with raised printing characters, a gear-sector, a hub and two rack-retaining discs. Each blank is made by rolling numerals on a shallow cup-pressing, which is first pinch trimmed and swaged. After rolling, the cup is trimmed on a lathe and is split by sawing to produce four blanks. Gear-sectors are produced on a press from copper-coated strip to permit selective hardening to avoid distortion. They are spot welded to the blanks in a specially equipped machine, and the welded assemblies are hardened in a controlled atmosphere furnace. After hardening, a hub and two rack-retaining discs are fitted to the assembly and are secured by a spinning operation. (MACHINERY, 93—26/11/58.)

The Importance of Appearance in Heavy Engineering

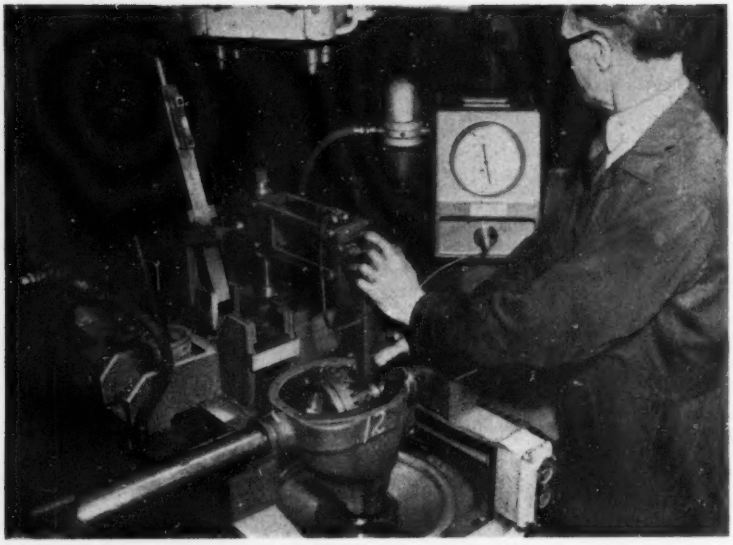
At a conference on industrial design and the engineering industries, which was organized by the Council of Industrial Design and held recently in Birmingham, various speakers laid emphasis upon the growing importance of good external appearance of heavy engineering products, always provided that such appearance is not gained at the expense of efficient functioning of the machine or other form of installation, and that adequate attention is also paid to ease of maintenance. To some extent, of course, the benefits to be derived from the use of a machine with pleasing external lines, as compared with one of strictly utilitarian design, are difficult to assess, and many production engineers, particularly, it is understood, in the U.S.A., have found it necessary to insist on high standards of accessibility regardless of the æsthetic effects. On the other hand, if the often difficult task of reconciling the various conflicting requirements can be successfully overcome, the company whose product is more appealing to the eye may be at a considerable competitive advantage, particularly in export markets. This point was stressed by the Rt. Hon. Lord Mills, K.B.E., Minister of Power, in his opening address to the conference. "In this very competitive world," he said, "managements which neglect to use the most up-to-date techniques, whether of finance, administration, or design, cannot flourish. It is still a commonplace that many companies sell machines which were designed 50 years ago. They can consider themselves fortunate that they are here to tell the tale." He went on to express the opinion that an efficient machine, embodying the latest in technical achievements, should be designed to please the eye and give the promise of its performance. "In overseas markets, of course, this is even more important, for here the customer does not, except in a minority of cases, see the product in being. Usually he judges on the written specification, the price, the reputation, and the appearance as seen in the brochure."

Another paper, which was presented by Sir Gordon Russell, C.B.E., M.C., R.D.I., F.S.I.A., was concerned with the functions of the Council of Industrial Design and the services which it could offer to industry. It was explained that the potential field had been arbitrarily divided into three sections, namely, heavy industry, durable consumer goods, and fashion, clothing and accessories. Attention had initially been concentrated on the second section, but the Council had always desired to be of assistance to the engineering industries which made such important contributions to the export trade of the country, and they had already received considerable encouragements from certain firms in those industries. There was a growing feeling in many firms, he suggested, that gaps existed in the arrangements for reconciling the appearance of their products with their convenience in use. "An even bigger gap exists in formulating comprehensive design policies so that a firm projects a clear picture of itself in everything it does—its products, advertising, stationery, vans, showrooms, offices, exhibitions, and so on."

Various papers were concerned with more practical aspects of the implementation of the conference theme. For example, Mr. Louis Schuler discussed the appearance design of power presses, and whereas his remarks were intended to apply specifically to machines of this type, much that he said was obviously of wider application in the heavy engineering field. His general outlook he expressed in these words: "If æsthetic design of the highest order is employed in the building of machines, these otherwise lifeless objects can be infused with life and character, the power of which may be such as to intoxicate the user or operator of the machine with a desire for high achievement."

Like the other speakers, however, he was at pains to make clear that while he considered appearance design to be of "real and serious importance," it must not interfere with the technical efficiency of the product, but must rather be an expression of it. The required result could not be achieved by superimposing an artistic external design, and it was an important duty of management to guard against the desire of some designers to consider external appearance before utility. Frequently, in the past, designers had been restricted by limitations imposed by the constructional methods then available, and it was important that advantage should be taken of advances in production techniques. Improvements in casting methods, for instance, had enabled more complicated shapes to be obtained, and the introduction of welded construction had offered, to the press designer, various opportunities for obtaining good appearance. Trouble taken in this respect was

(*Continued on page* 1263)



Producing the Vauxhall Victor

Operations on Hypoid Pinions and Axle Assembly Methods

Earlier articles in this series* have been concerned with the production of gearboxes and stub axles, also rear axle housings, tubes and half-shafts for the Vauxhall Victor car which was first introduced early in 1957. This article is concerned with the machining of hypoid pinion blanks at a fully automatic set-up, which provides for gauging in addition to loading and unloading operations, also with certain of the assembly operations on the rear axle.

A drawing showing the shape and main dimensions of the hypoid pinion blank is given in Fig. 1, and it is machined from an alloy steel forging which is supplied with excess metal of ⅛-in. average thickness, except at the small end where the amount of material to be removed is somewhat greater. Normalizing and shot-blasting is carried out in the well-equipped centralized heat treatment area before the blanks arrive at a Fraser automatic machine on which they are face-milled at each end and centre-drilled. A code indicating the steel batch number and the number of teeth to be cut on the pinion is then stamped on one end face, before the forgings are transferred to a French-built H.E.B. Pilot [Drummond-Asquith (Sales), Ltd.], hydraulic copy-turning lathe, a general view of which is given in Fig. 2.

This machine is arranged for completely automatic loading and unloading, and automatic electronic gauging equipment is fitted which provides visual indication when the need for adjustments to the tools becomes imminent. In addition, this equipment will stop the machine should certain dimensions exceed the set limits. The component to be turned is held between centres and is driven by the chisel-pointed ends of three plungers which are forced into the end face of the head during the loading operation. Above the work there is a hydraulically-fed slide carrying two tools which are applied initially to rough face the large end of the head and to chamfer the small end. For this operation a spindle speed of 750 r.p.m. is employed, and the tools are fed straight in to depth at 0·008 in. per rev.

Movements of the tools mounted on each side of the work, on the inclined copying slide, are controlled, by means of compound templates carried on an indexing carrier at the rear of the machine, through a stylus valve attached to the upper end of the slide. The driving mechanism

* MACHINERY, 92/760–4/4/58; 92/944–25/4/58; 92/1316–6/6/58; 93/512–3/9/58; and 93/1036–5/11/58.

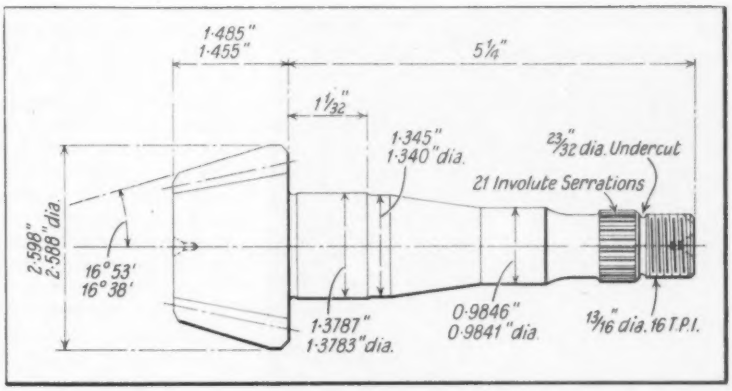


Fig. 1. The hypoid pinion shaft for the rear axle of the Vauxhall Victor car, which is machined from an alloy steel forging

for the template controls the spindle speeds and feed rates, according to the diameter being turned, also the direction of the feed. As the plunge-feed slide approaches full depth, the saddle is moved to the right, and the front tool is then advanced towards the work to rough turn the small end of the shaft up to the recess adjacent to the serration diameter.

This tool is then returned to the right-hand end of the shaft, and is fed to full depth for finish-turning the remainder of the shaft, leaving allowances for grinding on the bearing diameters. These operations are performed at a spindle speed of 1,500 r.p.m. and with a feed of 0·014 in. per rev., and as the tool is retracted it takes a finishing cut across the rear face of the head. Next, the rear tool on the copying slide is brought into operation to produce the chamfer at the large end of the head, and turn the outside diameter, and the tapered portion on which the teeth are to be cut. At the end of the copying motion, the slide is fed at 90 deg. to the component axis, and a narrow tool plunge-forms the undercut between the diameters for the serrations and the threaded end of the shaft, to $\frac{23}{32}$ in. diameter. For these operations, the spindle speed is reduced to 750 r.p.m., but the feed rate is not changed. The complete operation cycle of the machine occupies 70 sec.

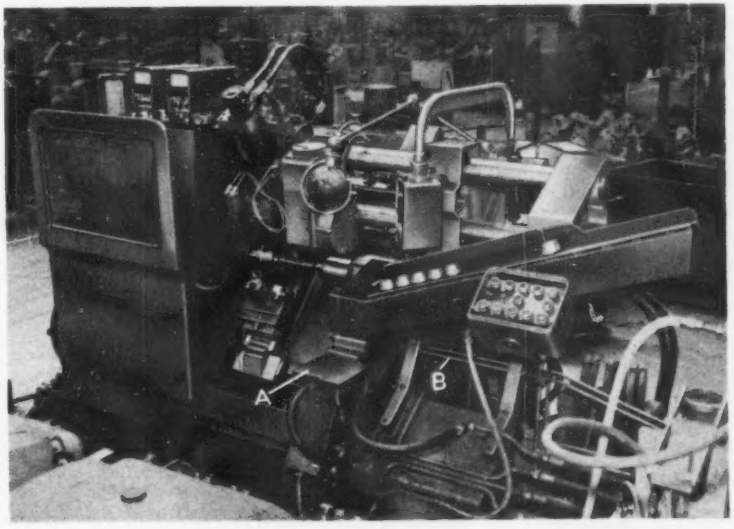


Fig. 2. The hypoid pinion shaft is finish-turned on this H.E.B. Pilot lathe, in a cycle time of 70 sec. Automatic loading, unloading and gauging equipment is employed

AUTOMATIC GAUGING EQUIPMENT

Two Stop-Cote gauging units are employed for measuring the outside dimension of the head and the adjacent large bearing diameter, and the indicator cabinets for these units are seen on the headstock of the lathe at the left in Fig. 2. The gauging heads are carried on a swinging arm above the workpiece, as shown in the close-up view, Fig. 3, where they are seen engaged with the surfaces mentioned. For the head diameter, the tolerance is 0·010 in., and for the bearing diameter, at this stage, 0·003-in., and the positions

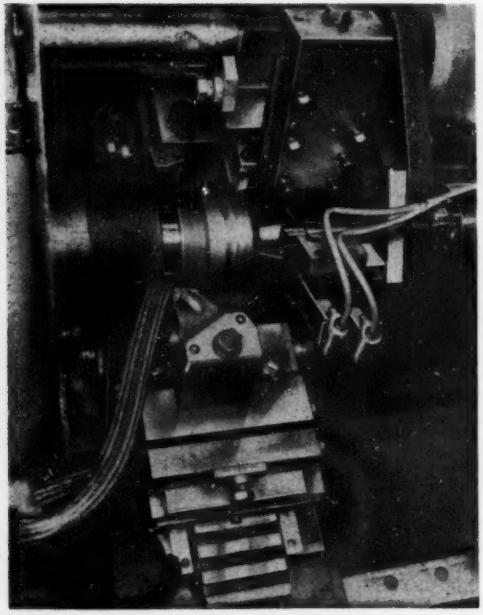


Fig. 3. Close-up view of the H.E.B. lathe showing the Stop-Cote gauging heads in contact with the two diameters which they measure on the work-piece at the end of the machining cycle

which the actual sizes measured occupy in relation to the tolerance bands are directly indicated by dials on the Stop-Cote cabinets. In addition, each cabinet carries a row of four lights (green, white, red and amber), which readily indicate to the operator the condition of the two copying tools.

When the component is oversize, on the diameter in question, the green light is illuminated and when it is undersize, the red light. The white light indicates that the component is within the pre-set limits, and as the tools wear the amber lamp is illuminated to show that the diameter is approaching the upper limit and that a tool adjustment will shortly be required. When either the red or green light is switched on, the machine cycle is stopped with the gauge heads still in position on the work, and the lamp remains illuminated. Quick-change tooling is employed on the machine to permit of rapid re-setting, the Cintride front copy-turning tool being of doube-ended triangular form with six carbide-tipped cutting edges, which can be employed in succession.

AUTOMATIC LOADING AND UNLOADING

Blanks from the facing and centring machine are loaded into the magazine chute at the right in Fig. 2, in which they are suspended by their heads, and move down, under gravity, to the escapement position at the lower end. Here, the forgings are stopped by a pin which projects across the end of the chute. Rack teeth on the rear end are engaged by a pinion to advance and retract the pin when a shaft is to be released from the chute. On the other side of the pinion there is another pin with a tapered end, and the two pins are so arranged that as the lower

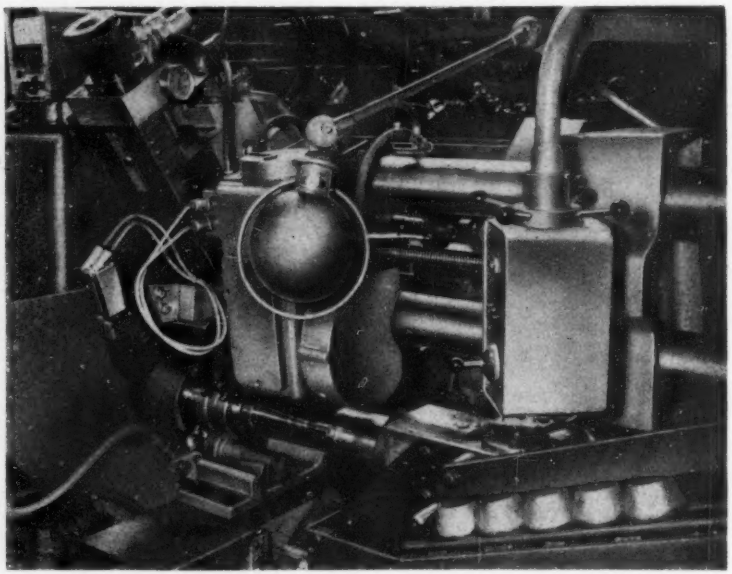


Fig. 4. At the end of the machining cycle a forging, released from the magazine during the previous cycle, is carried to the position shown (left), to be loaded in place of the finished component

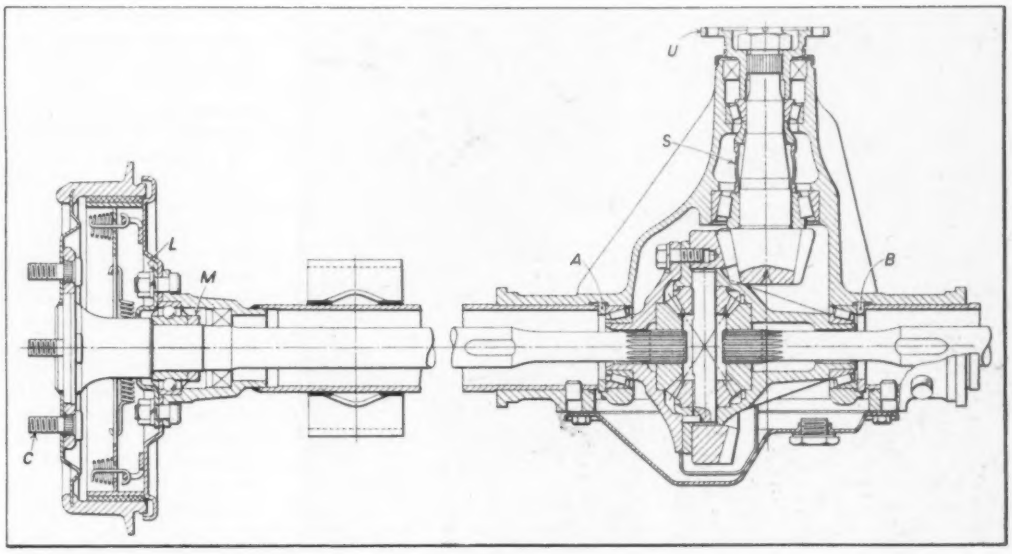


Fig. 5. A sectional view of the differential and one end of the rear axle for the Vauxhall Victor car. The wheels are secured directly to forged flanges on the half-shafts

one is retracted to allow a forging to leave the chute, the upper pin is advanced to prevent the remainder from moving. The upper pin is then retracted, and the lower advanced, to allow the forgings to move down one space.

During the machining cycle, the inclined loading slide A, Fig. 2, supported on a travelling carriage on special ways at the front of the bed, above the tool slide, occupies the position shown, beneath the lower end of the chute. As the fresh blank falls from the chute, its lower end is arrested momentarily by a projection, and it is caused to assume a horizontal position in the cradle on the loading slide. Guards surrounding the end of the chute confine the movements of the forging so that it is fairly accurately located end-wise in the loading cradle in which it is supported on pads of hardened steel.

At the end of the machining and gauging cycle, the loading slide is moved to the position shown in the close-up view, Fig. 4, and a channel-shaped receiver, at the inner end of the slide, is then positioned directly beneath the finish-turned part. Next, the tailstock centre is retracted, and a spring-loaded sleeve on the headstock spindle pushes the component off the driving blades and the headstock centre, whence it falls into the channel. The loading slide is now further advanced, and its angle of inclination is such that the centre-holes of the unmachined forging in the cradle are brought into alignment with the spindle axis. With the work in this position, the tailstock centre is again advanced, pushing the forging into engagement with the headstock centre and causing the sharp teeth of the work-drivers on the spindle nose to bite into the end face.

Retraction of the loading slide coincides with the start of the automatic machining cycle, and the newly-finished shaft is carried to the right when the slide returns to the position shown in Fig. 2. As the slide reaches this position, the finished shaft is moved past a spring-loaded latch at the end of the support ways *B* Fig. 2, other finished shafts on these ways being pushed to the right. Another blank from the magazine is then released on to the loading slide, and when the latter is again moved to the left, for the next loading cycle, the previously finished shaft, retained by the latch, is swept off the cradle and remains supported in a substantially horizontal position on the ways. Successive movements of the loading slide cause the finished shafts to travel along the ways until they reach the inclined portion at the right-hand end and slide down into a container.

From the H.E.B. lathe, the forgings pass to a Landis (Alfred Herbert, Ltd.) screwing machine on which the $\frac{13}{16}$-in. diameter, by 16 U.N.S.-2A thread is cut at the small end, and a locking slot

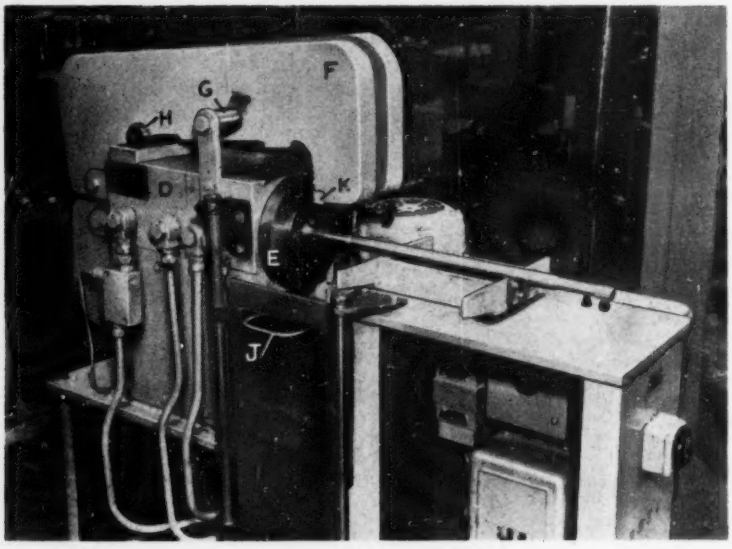


Fig. 6. A special Hi-Ton Hydraulic press is employed to press the wheel-retaining studs into the flange holes and to peen them in position automatically

is then milled in one side of the threaded portion. Next, the 21 spline serrations, which have a diametral pitch of 24/28 and a pressure angle of 45 deg., are cut on a Rigidhobber (Churchill Gear Machines, Ltd.), and the two bearing diameters are finish ground, by the plunge method, on a Newall LA machine. The latter is fitted with Mercer spark-out control equipment which stops the in-feed just before the required size is reached, and causes the grinding head to return at the completion of the dwell period. The diameters are held within a tolerance of 0·0005 in. on this machine. Finally, the components are transferred to the hypoid gear cutting section, which is equipped with a battery of Gleason (Buck & Hickman, Ltd.) machines, and the teeth are rough cut, and then finished successively on the driving and coasting sides. The completed pinions are selectively matched with the associated ring gears.

ASSEMBLY OF HALF-SHAFT STUDS AND BEARINGS

A sectional drawing showing the construction of the rear axle is given in Fig. 5, from which it may be seen that no separate hubs are employed. Instead, each half-shaft has a forged flange in which there are four drill-reamed holes for the insertion of headed studs *C* whereby the wheel is attached, and details of the production of half-shafts, up to the stage at which these studs are inserted, were given in the last of the articles to which reference is made in the footnote on page 1212. The stud employed is about 1½ in. long overall by $\frac{7}{16}$ in. diameter. It has a flat circular head, and a step of about $\frac{3}{8}$ in. diameter between the underside of the head and the threaded portion. This step is provided with a number of fine-pitched serrations parallel with the stud axis, and is of sufficient length to project slightly on one side of the flange when the underside of the head is pressed into contact with the other.

The stud is made from high tensile steel and hardened, and the serrated portion is an interference fit in the hole in the half-shaft flange. Consequently, when the stud is forced into the hole it cuts matching serrations in the bore and is thus prevented from turning with the wheel nut. After the studs have been forced home, the slightly proud end of the serrated portion of each is peened over as shown in Fig. 5, to spread the metal and prevent the stud from leaving the flange in service. The four studs are pressed into place simultaneously, and the serrated portions are peened, in a very short cycle time, on the special Hi-Ton [Drummond-Asquith (Sales), Ltd.] hydraulic press shown in Fig. 6.

SPECIAL HI-TON PRESS

This press has a central pressure block *D*, with a circular machined plate *E* on the front vertical face for the location of the flanged end of the half-shaft by means of two large-diameter dowels which enter holes between those for the studs. The small end of the shaft is supported in V-grooves in an outrigger bracket, carried on a steel-topped cupboard which houses the control equipment for the machine. Within the block *D* there are five horizontal hydraulic cylinders, all with their axes parallel. Four of these cylinders are employed to press the studs into place and these are arranged at the corners of a square, with the fifth cylinder,

which provides for the peening operation, in the centre, so that its axis is aligned with that of the shaft.

The ram of each of the four pressing cylinders projects from the rear face of the block *D* and is connected, by means of a stirrup, to a hooked pressure beam, as at *F*. There are four of these beams, two above and two beneath the block *D*, and they have pads on their inner faces which hold them at the correct distance apart, the outer faces being guided by pressure pads *G*, carried on steel bars at each side. On the side of each beam adjacent to the block *D* there is a pair of rollers, one of which is seen at *H*, and the rollers on the upper pair of beams are held by gravity in contact with hardened cam surfaces on top of the block. Similar arrangements are provided for the other two beams, beneath the block, except that they are thrust upwards by spring pressure.

After a shaft has been loaded into the position shown, and the four studs inserted into the holes as far as possible, by hand, the automatic machine cycle is started by raising the transparent plastics guard by means of the handle *J*. The guard is held in the raised position by a latch, and it operates a micro-switch to complete the circuit to a solenoid valve which controls the direction of the oil supply to the four stud-pressing cylinders. Should the guard be lowered during the cycle, this valve automatically returns to the setting at which the rear ends of the cylinders are connected to exhaust. Pressure oil supplied by the valve to the four cylinders causes movement of the rams towards the rear of the machine, carrying with them the four beams *F*.

As the beams move, the rollers *H* ride down their cam surfaces and as a result the front end of each beam is moved downwards or upwards, according to its position, until the inner face of the hooked portion at that end is level with a stud. Further movement of the beams towards the rear carries the rollers *H* on to a horizontal surface, and each beam then moves horizontally until a hardened pressure pad *K* on the inner face at the front end comes into contact with a stud. When all the studs have been pressed home in the flange holes and the undersides of the heads are in contact with the flange face, pressure builds up in the cylinders and a pressure-operated valve is actuated.

This valve controls the supply of oil to the central hydraulic cylinder in the block *D*, the ram of which is connected to four tubular peening sleeves behind the machined plate *E*. The axes of these sleeves are aligned with those of the studs and when they are advanced towards the half-shaft flange they are forced into contact with the enlarged serrated portions. Sufficient pressure is then exerted to spread the metal and ensure that each stud will be retained in its hole under all normal service conditions.

An electric timer controls the period for which pressure is exerted on the peening sleeves, and at the expiry of the pre-set time, the valve setting is reversed. When the sleeves have thus been withdrawn and the beams returned to their original positions, the assembly is unloaded. Two pumps, mounted as a self-contained unit and driven by motors of 4 h.p., supply pressure oil to the cylinders.

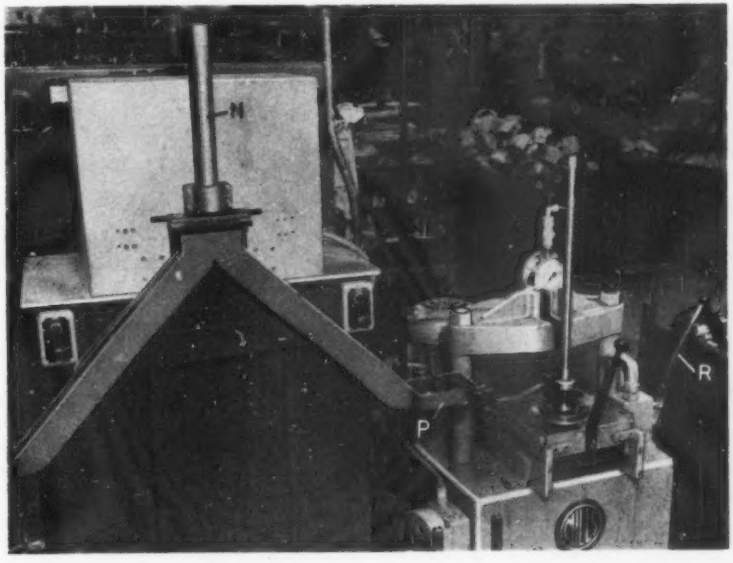


Fig. 7. Retaining rings to be fitted above the bearing on the outer end of the half-shaft are induction heated in a semi-automatic unit (left) before being fed to the special Mills press on which they are forced into place

BEARING AND RETAINER ASSEMBLY

From the stud assembly machine, each half-shaft is transferred to an adjacent press for the fitting of the roller bearing, and its associated retainer flange and ring, at the large end. A pressed steel flange *L*, Fig. 5, with holes to suit those drilled in the axle tube flange is first placed over the shaft followed by the ball bearing, which is of sealed construction, and then the steel ring *M*. This ring is a shrink fit on the shaft and must therefore be heated before it can be pressed into place, and the equipment provided for this purpose is shown in Fig. 7. Retaining rings are raised to a red heat by means of the Philips 2·5 kW. induction heating unit at the left, which also serves to heat rings for another type of axle shaft, for Velox and Cresta cars, on which assembly operations are performed nearby.

Operating on a frequency of 540 kc. per sec., this unit has a semi-automatic feed magazine for the rings, in the form of a cylindrical tube *N*, with a longitudinal slot in one side. Beneath the open end of the magazine is the inductor coil, in which the rings are a loose fit, and current is supplied to this coil for a timed period, sufficient to heat a ring to the required temperature, when the appropriate button at one side of the unit is depressed. Below the coil there is an escapement mechanism consisting of two plates, in each of which there are two holes of sufficient size to hold a ring. The lower plate is fixed, and the holes are located above the two inclined chutes seen leading down from each side of the magazine.

When the upper plate is moved to a position in which either hole is beneath the stack of rings in the magazine, the stack moves down and the lowest ring enters the hole. In this position, the lowest ring is within the heating coil and the button is depressed to start the heating sequence. At the end of the heating period the upper plate is moved to one side or the other, according to demand, carrying the heated ring with it until the holes in the upper and lower plate coincide, and the ring then falls through and slides down the chute into the tray *P*. From this tray, the ring is picked up with the aid of the scissor-type tongs provided, and placed over the upper end of the half-shaft, which has previously been loaded on to the travelling table of the Mills (Alfred Herbert, Ltd.) Oilaulic press at the right, and fitted with the required flange pressing and roller bearing.

This travelling table is guided by the inner sides of the tracks on which the four wheels run, and it is pulled out, to the position shown, for loading and unloading. Above the table, when it is in the pressing position, away from the operator, there is a cross-head supported on substantial posts and provided with a deep slot to clear the vertical shaft. The base of the machine contains the hydraulic ram whereby pressure is applied to the under-side of the table, when the latter is in the operating position, to lift it upwards. Upward movement of the ram is controlled by a valve operated by the lever *R*, which cannot be moved until the table is correctly located, and the table is raised until the heated ring, above the ball bearing, is pressed against the under-side of the cross-head. Further movement of the ram then presses the bearing into position, against its locating flange on the

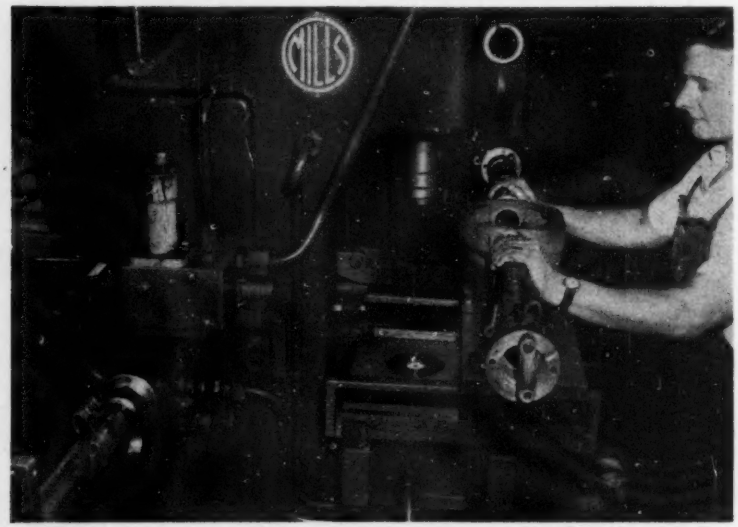


Fig. 8. Fitting of the outer rings for the taper roller bearings on which the pinion shaft is supported in the axle housing is carried out by the opposed vertical rams of this Mills press

shaft, and as the ring cools, it grips the shaft to retain the bearing in place.

ASSEMBLY OF DRIVING PINION SHAFTS TO AXLE HOUSINGS

The first step in assembling a driving pinion shaft to an axle housing is to measure the distances from the centre-line of the drive shaft bore to the inner faces of the axle tubes which project slightly into the housing, also the distance from the internal shoulder of the drive shaft bore to the lowest point of the differential bearing cap bore. When the amounts by which these measurements differ from the nominal dimensions specified have been marked on the axle housing it is transferred to the Mills Oilaulic hydraulic press seen in Fig. 8, on which the outer rings of the two taper roller bearings for the pinion shaft are pressed into position.

Rated at 12 tons capacity, this press has a conventional downward-acting ram whereby one of the races is pressed into place, and it is fitted with an additional ram beneath the table, to enable the second race to be assembled simultaneously. Support for the axle housing is provided by a roller-mounted table, which is guided by the sides of the lower ram housing, and is fitted with V-blocks whereon the axle tubes are located. A hole near the centre of the table locates the cast housing and provides for the entry of the lower ram, and in preparation for the pressing operation, the bearing inner rings are placed in position on the ram spigots, where they are retained by spring-loaded balls. The loaded table is then moved away from the operator, up to a stop, and is positively located by a pin, which must enter a hole in the table before pressure can be applied to the rams.

ACCURATE PRE-LOADING OF PINION SHAFT BEARINGS

Both the pinion-shaft and differential bearings are pre-loaded to minimize deflections of the shafts in service, and for the pinion shaft this operation is performed on a special machine, a general view of which is given in Fig. 9. Built by the Macdowall Equipment Co., Ltd., Romford, to Vauxhall Motors' specification, this machine is designed to apply a specified pre-load to the two taper roller bearings whereby the pinion shaft is supported in the axle housing. Pre-loading is effected by tightening the nut on the end of the pinion shaft with the result that the two bearing inner races are drawn together, compressing and deforming the collapsible spacer *S*, Fig. 5. The spacer consists of a short tube with walls of reduced thickness over the greater part of the length, which can be compressed by a specified loading at each end, and the machine is designed to provide the required degree of loading automatically.

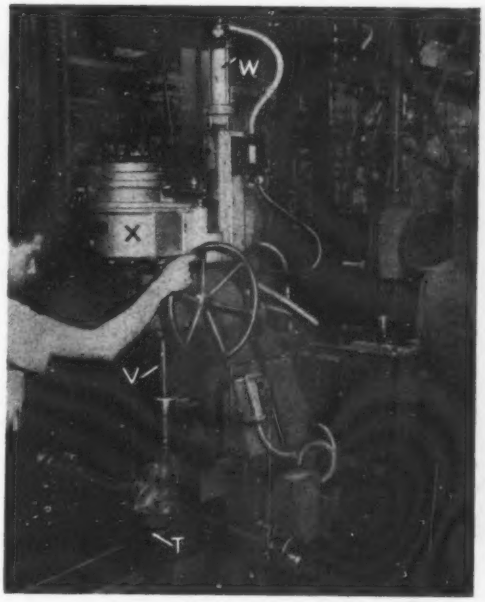


Fig. 9. Special machine built by MacDowall Equipment Co., Ltd., for the controlled tightening of the flange-retaining nut on the end of the pinion shaft to accurately pre-load the taper roller bearings

In construction, the machine somewhat resembles a conventional vertical drill, and it has a vertically-moving, counter-balanced table *T*, on which the axle housing is loaded with the flange face downwards. Before it reaches this machine, the housing has been fitted with its pinion shaft, carrying one inner roller bearing race at the head end, and with the second race, the driving flange *U*, Fig. 5, for connection to the propeller shaft on the car, and a hexagon nut at the smaller end, this work being performed at an adjacent press and bench. After placing the housing in position, the handwheel is turned to lower the vertical shaft *V*, Fig. 9, into engagement with the upper end of the pinion assembly. This shaft is of composite construction, comprising an inner shaft and an outer sleeve, and the inner shaft carries a male centre which engages the centre hole in the upper end of the pinion shaft, also a spring-loaded hexagon socket to fit the nut.

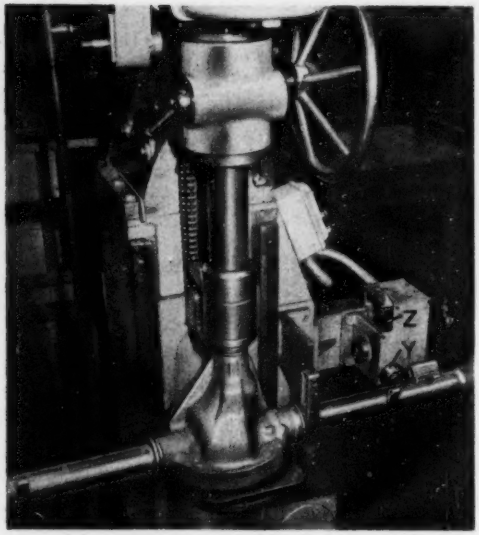


Fig. 10. Close-up view of the MacDowall machine showing details of the spring-balance whereby the torque transmitted through the bearings to the axle is measured, and the micro-switch *Z* for stopping the tightening action

The outer sleeve has a dowel pin to engage one of the holes in the driving flange *U*, Fig. 5, and when both sleeve and shaft have been coupled to the pinion shaft, the housing is pushed down to the position shown. Beneath the table there is another vertical shaft, with a centre which enters the centre hole in the head of the pinion shaft. At this stage, the pinion shaft is held between centres with the main weight of the axle supported by the counter-balanced table *T*. The lower machine shaft carries a brass driver which engages the hypoid teeth of the pinion and rotates it when the starting button for a driving motor in the machine base is depressed. The lower shaft and, consequently, the pinion, together with the upper shaft and its outer sleeve, is then driven for a short period before a switch is operated to complete a circuit to an Electroaire (Benton & Stone, Ltd.) solenoid air valve at the upper end of the cylinder indicated at *W*.

The piston rod of this cylinder is thus caused to operate the lever of a clutch within the gear-box *X*, and the inner shaft within the sleeve *V* is then caused to rotate at a speed approximately 1 r.p.m. less than that of the lower shaft. In this manner the shaft is slowly screwed into the nut, and when the spacer has been collapsed, sufficient torque is transmitted to the axle housing through the bearings to cause the housing to turn also. A closer view of the machine from the opposite side is given in Fig. 10, and it will be seen that a bracket at the right carries a small metal box with a boss *Y*, on the front face, from which projects a horizontally-disposed axially-moving plunger.

This plunger is connected to a spring-loaded lever, and when the housing turns, the plunger is pushed into the box causing the upper, pointed end of the lever to move across

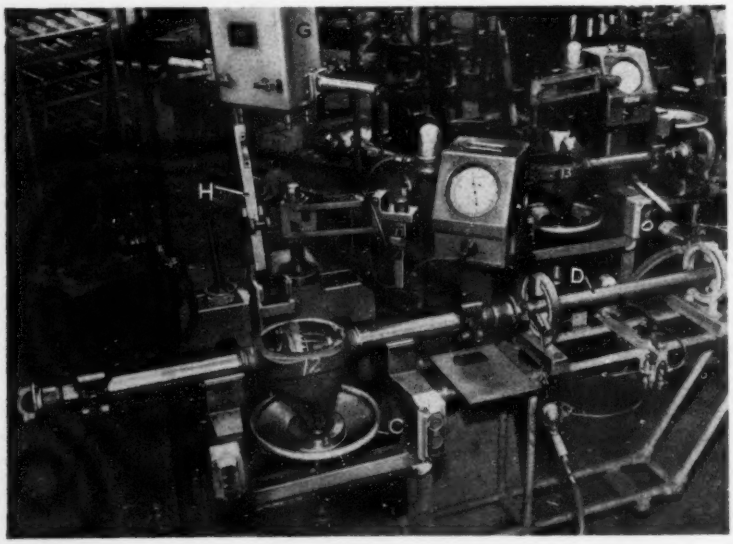


Fig. 11. This rig is employed for measuring the back-lash between the teeth of the pinion and the driving wheel, which is held to 0·006/0·008 in., and for determining the thickness of the spacer to give the required degree of pre-loading of the differential bearings

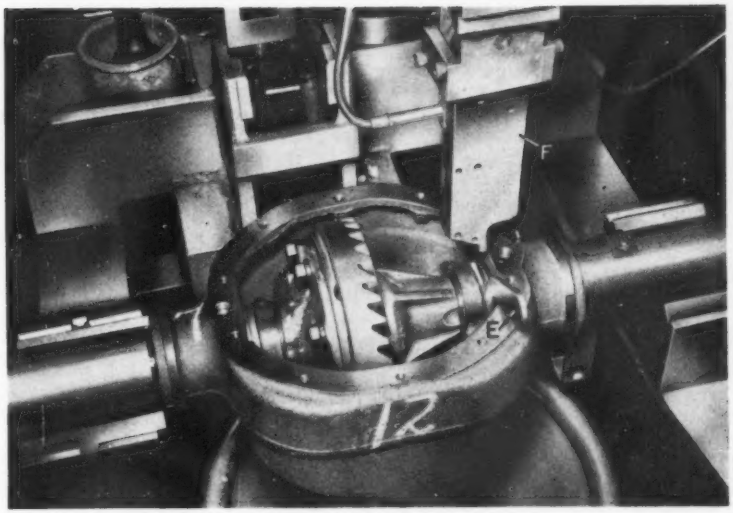


Fig. 12. Close-up view of the axle housing in position on the rig in Fig. 11, showing the measuring head *F* swung forward to determine the required thickness of the right-hand spacer, which replaces the pressure plate *E* in the finished assembly

a scale graduated in lb.-in. At the end of its movement, the lever operates the plunger of a micro-switch Z, which is connected to the Electroaire valve of the cylinder *W*, Fig. 9. This cylinder then disengages the clutch driving the hexagon nut, and no further tightening occurs. Normally, the unit is adjusted so that pressure on the nut is released when a preloading torque of 6 to 10 lb.-in. has been applied. This procedure occupies about 3 min., and the pre-loading is found to be extremely consistent over long periods. When preloading has been completed, the gear ratio for the axle is stamped on the side of the housing and it is transferred to an adjacent machine, on which the differential sub-assembly is fitted. It may be noted that since the notes and photographs for this article were prepared, the pre-loading machine has been modified by the fitting of an electrically-operated clutch.

FITTING THE DIFFERENTIAL SUB-ASSEMBLY

In addition to pre-loading the bearings whereon the differential sub-assembly and driving wheel are carried, which is accomplished by the fitting of spacers *A* and *B*, Fig. 5, of appropriate thickness, it is arranged that the teeth of the wheel and pinion make contact approximately at the centre to ensure that wear will take place evenly, and to enable the full designed load carrying capacity to be obtained. Measurement of the exact size of the spacer required for a particular axle, and subsequent testing of the assembly to determine whether the driving wheel has been correctly positioned, are carried out with the aid of the special equipment shown in Fig. 11, of which several sets are installed in the works. Each rig provides for driving the pinion shaft in either direction through a Matrix multi-disc, air-operated clutch, and a vertical shaft which projects upwards from the base, a handwheel *C* being provided for small movements.

As may be seen from Fig. 11, V-blocks are provided on the framework of the rig to support the axle tubes, and the driving flange on the end of the pinion shaft is engaged by dowel pins in a recess in the handwheel *C*. At the first stage of the fitting operation, the differential sub-assembly is placed in position, with a spacer of suitable thickness interposed between the face of the outer ring of the left-hand taper roller race and the end of the axle tube. The thickness of this spacer is determined from the measurement, made earlier, of the distance from the end face of the left-hand axle tube to the centre of the pinion shaft bore. Pressure is now applied to the right-hand end of the differential sub-assembly to thrust it against the spacer, by means of a long-stroke air cylinder *D*, supported on an outrigger bracket at the right.

With this pressure exerted, the amount of backlash between the two gears is checked with the aid of a dial gauge, and the thickness of the left-hand spacer *A*, Fig. 5, is increased or decreased, if necessary, until this backlash is between 0·006 and 0·008 in. With a little experience, an operator can estimate accurately the amount by which the spacer thickness requires to be changed. Attention is next directed to the right-hand bearing, and the thickness of the spacer *B*, Fig. 5, required between this bearing and the end of the axle tube at that side is measured with the aid of the Mercer air gauging unit seen in use in the heading illustration. A close-up view of the gauging head of this unit, which is carried on spring-counter-balanced

parallel-motion arms, on a post at the rear of the rig, is given in Fig. 12.

Here, the cut-away plate through which pressure is exerted by the air cylinder ram on the differential bearing is indicated at *E*, and with the pressure applied, the reduced end portion of the measuring head *F* is inserted between the bearing and the end of the axle tube. The thickness of the spacer required for correct pre-loading of the two differential bearings is then indicated on the large-diameter Mercer dial indicator, which is graduated in 0·001 in. divisions, and this spacer is now fitted in place of the plate *E*. Differential bearing caps, which were attached by nuts and bolts to the flanges at the ends of the axle when they were removed at the start of the assembly operations, are now fitted to the axle, and the holding-down bolts are tightened with the aid of the special 4-spindle Thor controlled-torque spanner unit *G*, Fig. 11.

The hexagon sockets in this unit are spaced to match the positions of the bolt heads in the bearing caps, and all four bolts are tightened simultaneously. With the bolts tightened, yellow oxide paint is applied to the gear teeth and the pinion is driven through the motor and clutch unit, previously mentioned, to obtain an indication of the relationship of the teeth on the pinion and the wheel. During this test, a load is applied to the periphery of the wheel, to simulate service conditions, by means of the lever *H*, which is pivoted in a bracket at the rear of the rig. This lever has a ball handle at the outer end, and carries a pad which can be brought into contact with the wheel periphery to apply the load. This test is applied mainly for confirmation of the correctness of the preceding assembly sequence, rather than inspection of the axle, and very few assemblies are rejected at this point.

After it has been removed from the differential assembly rig, the axle passes to a moving belt on which the remaining sub-assemblies, including the half-shafts, brake units, and drums, are fitted, and thence by way of a painting booth, to a conveyor on which it travels to the car assembly track in an adjacent building.

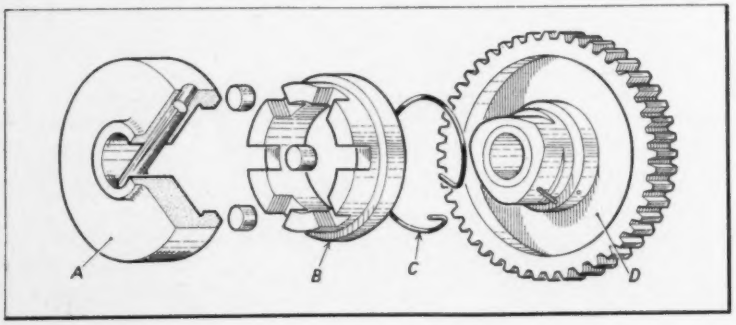
Tiltman Langley Freewheel Unit

The accompanying line drawing shows an exploded view of a new freewheel unit which has been developed by Tiltman Langley, Ltd., Redhill Aerodrome, Surrey. This unit will transmit up to 0·5 h.p. at 1,500 r.p.m., according to the load conditions, and will operate at temperatures ranging from −40 deg. C. to those encountered in the tropics.

Normally, the housing *A* is the driving member, and is connected to the transmission shaft by a Mills pin. The reduced-diameter portion of the cage *B* has slots to hold three rollers, and there is a spring *C*, one end of which is attached to the gear *D*, and the other to the cage. This spring exerts a force on the cage in an anti-clockwise direction, as viewed in the figure, and is provided to eliminate any backlash and ensure a smooth take-up of the drive.

When the housing is rotated in the same direction as the spring reaction, the rollers are wedged between the bore and the lobes on the gear, thereby transmitting drive to the latter. If the gear *D* is rotated faster than the housing, the unit will freewheel, and if the drive is stopped, the gear will continue to rotate independently of the housing.

Alternatively, the gear *D* can be used as the driving member, in which case—unless the spring is changed—the direction of rotation of the unit must be reversed. The complete assembly is located longitudinally by means of a plain collar, which is pinned to the transmission shaft and abuts the outer face of the gear *D*.



Perspective View of the Components of the Tiltman Langley Freewheel Unit

Combined Research to Improve the Performance of Multi-spindle Automatics

If the optimum performance is to be obtained from a multi-spindle bar automatic, special attention must be paid to the quality of the machine, bar stock, cutting tools and holders, measurement-control equipment, coolant and lubrication, and there must be close co-ordination between the suppliers and operators of the machine and associated equipment. In order to promote the necessary standards of quality and collaboration, for the purpose of developing improved machining practices and lower production costs, a co-operative, non-profit making, research project has been undertaken by a group of suppliers in the U.S.A., on a permanent basis.

Workpieces that are representative of those required in large quantities in industry, and made from popular grades of steel with commonly used tool combinations, will be selected by the group for analysis and for production under conditions that simulate those in a normal works. A complete cost breakdown will be made, and the parts produced will be stamped, where practical, with the code-word "Comapro" (CO-operative MAchining PROject), and used as samples, or returned to the steel mills with the swarf.

The first component to be made is a spark-plug shell.

For this project, the Cone Automatic Machine Co., Windsor, Vt., U.S.A., have set up an enclosed Comapro department in one wing of its plant, and has provided a 6-spindle, 1⅝-in. capacity, Conomatic bar machine with the necessary operators. A general view of this machine is given in Fig. 1. Associated equipment supplied by the other sponsors and installed in this department includes a Jones & Lamson 30-in. screen, optical comparator, seen in Fig. 2; Federal Products adjustable, mechanical gauges; a Rockwell hardness tester; a Brush Electronics Co. Surfindicator; a Black Diamond drill grinder; Blake tap chamfer and flute grinders; and a Royal Oak universal, form-relieving tool grinder. A horizontal-spindle surface grinder is to be supplied by the Abrasive Machine Tool Co., but has not yet been installed.

The use of high-quality bar material and cutting tools is of major importance in obtaining optimum machining conditions. Work-material for the Comapro research programme is being supplied by Jones & Laughlin Steel Corporation and Joseph T. Ryerson & Son, Inc. Sparking-plug shells are being made from J & L Type A, leaded-steel bar stock, and the second component to be produced will be a bushing made from Ryerson 8630 leaded steel.

The initial production runs are being made with high-speed steel tools since they are the most widely used type on multi-spindle bar automatics, particularly for the fairly simple workpieces

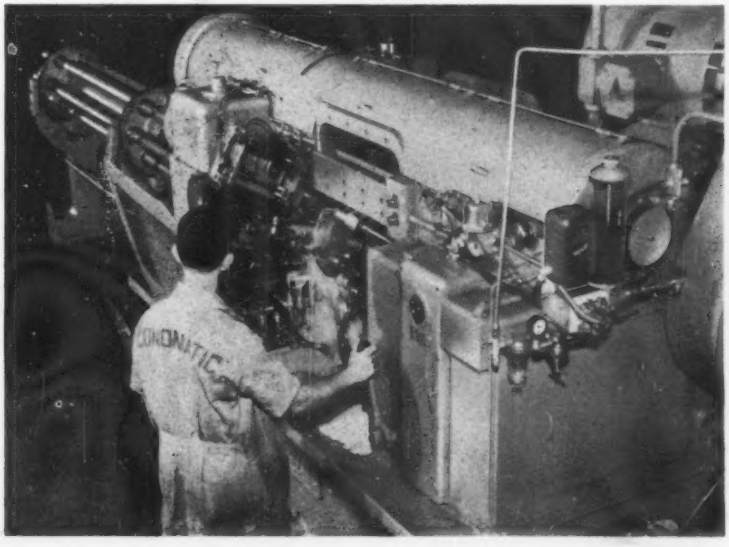


Fig. 1. General view of the 6-spindle, 1⅝-in. Conomatic set-up for the production of sparking plug shells

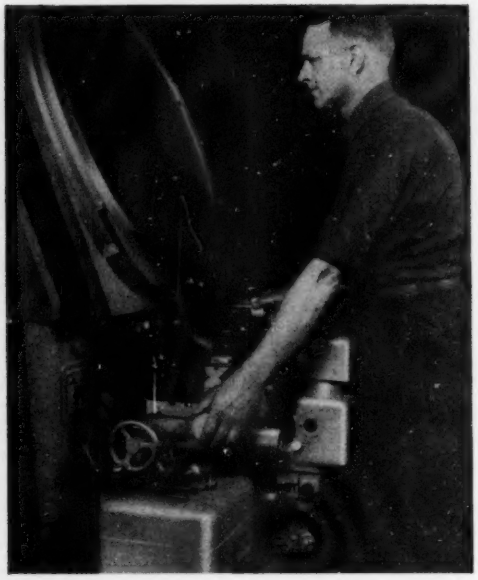


Fig. 2. An optical comparator with a 30-in. diameter screen is employed for inspection of the profiles of the sparking plug shells and cutting tools

required in large quantities that are being investigated in the Comapro project. However, since the ultimate objective is to develop low-cost production methods, cast-alloy and carbide tools, or a combination of both with high-speed steel tools, will be used whenever it is considered advantageous. Firth Sterling is sponsoring the high-speed steel, cast-alloy, and carbide materials for the forming, cutting-off, facing, turning, shaving, recessing, and trepanning tools. Ground thread taps are supplied by John Bath Co.; twist drills, counterbores, and reamers by the Cleveland Twist Drill Co.; and self-opening die-heads and hollow mills by the Thread Tool Division of the Jones & Lamson Machine Co.

Effective control of the cutting tools is accomplished with a "Toolitrol" board, Fig. 3, supplied by Scully-Jones & Co., which is electrically connected to the multi-spindle automatic, and provides a convenient method of pre-setting and storing sharpened tools. Gauges are provided for setting the sharpened tools correctly in quickchange holders. Counter switches, mounted behind locked panels on the board, are pre-set automatically to stop the machine for tool changing after a predetermined number of parts have been produced. The machine cannot be restarted until the panels have been unlocked and the counter switches reset.

The use of pre-set, quick-change holders permits the removal of blunt tools without recourse to wrenches, and their replacement with sharp tools in a fraction of the time necessary with conventional holders. Only 5 min. 40 sec. are required to remove and replace nine tools in the set-up for the production of the sparking-plug shell. With conventional holders, this operation would require 42 min. 35 sec. Since the cycle time under the prescribed conditions is only 4½ sec., the saving of 36 min. 55 sec. in the change-over time for a

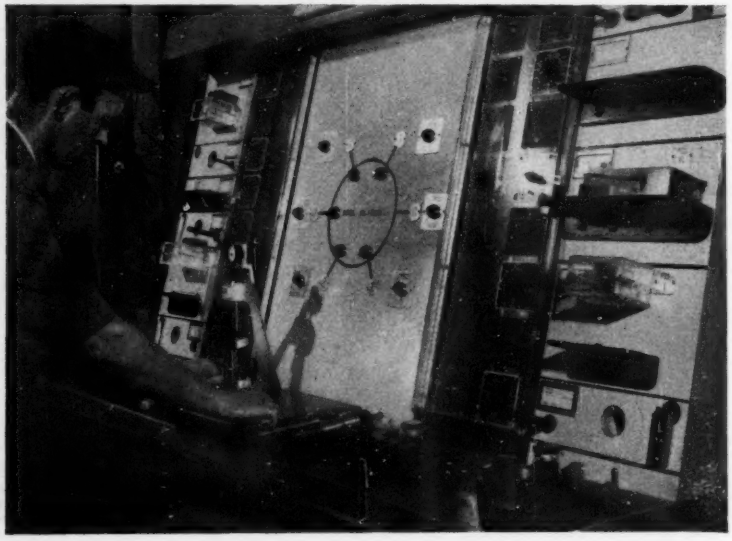


Fig. 3. This tool control board is equipped with gauges for pre-setting sharpened tools, and is arranged to stop the machine when tools need changing

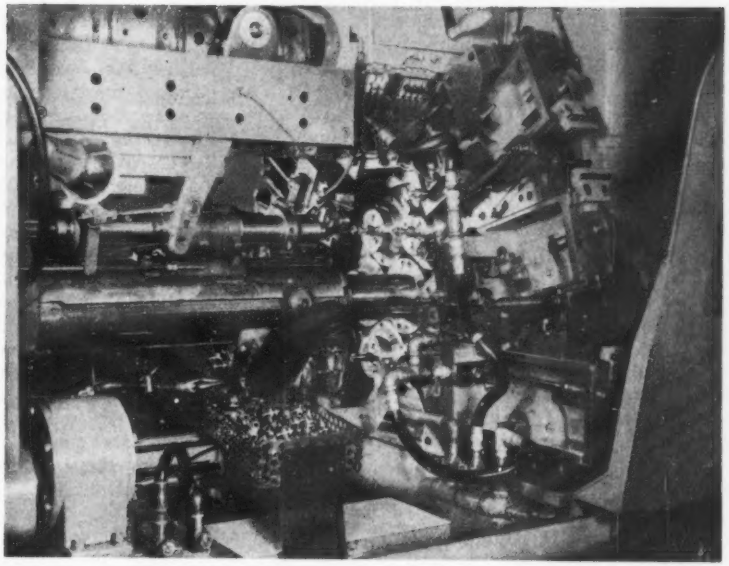


Fig. 4. Close-up view of the tooling area on the 6-spindle bar automatic. The machine operates on a 4½-sec. cycle

set of tools represents an increase in production of 492 parts.

Rapid heat dissipation and fire-resistant properties of water-soluble coolants have led to their widespread use on automatics that are effectively sealed to prevent the coolant mixing with the lubricating oil. Greases, lubricants, and coolants for the Comapro project are supplied by the Gulf Oil Corporation. For machining the sparking plug shell, the coolant is one part of "Gulf-cut," a heavy-duty soluble oil, diluted with 20 parts of water. Gulf "Seneca 54" is employed as the lubricating oil for the circulation system, and "Senate 110" for the main oil bath for the end-working slide. An electrically-timed, central lubricating system, supplied by the Lincoln Engineering Co., is fitted to the Conomatic to ensure proper maintenance of the machine's slower-moving, functional parts.

Standard equipment on the Conomatic includes master cams with adjustable working strokes for all tool-slides and bar feeding. Work-spindle speeds can be varied in 43 steps from 128 to 2,502 r.p.m., and there is a range of 34 feed rates. The machine is equipped with a special power-feed knock-off which is connected to the counter switches on the tool control board to disengage automatically the feed clutch.

A close-up view of the tooling area employed in

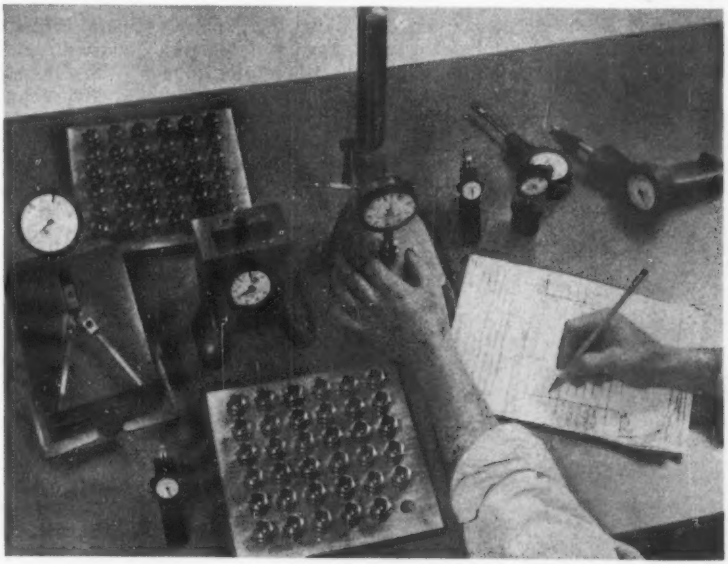


Fig. 5. A group of adjustable, mechanical gauges employed to check nine different dimensions on a completed spark-plug shell in a time of 1½ min.

the production of sparking-plug shells is seen in Fig. 4. The cycle time of the original set-up for these parts was 5½ sec. and the time has been progressively reduced to less than 4 sec. per part. A cycle time of 4½ sec. is now employed in an attempt to determine the optimum machining conditions. At the first position, a dovetailed form tool is mounted on the cross-slide, and a 0·527-in. diameter twist drill on the main end-working slide. Another form tool is provided on the cross-slide at the second position, and another drill on the end-working slide increases the depth of the centre hole in the hexagonal bar material. Knurling of the shell periphery is performed at the third position by means of a roll attachment mounted on the cross-slide, while a sub-land drill on the end-slide is fed into the bar. At the fourth position, a shaving attachment is mounted on the cross-slide, and a 0·328-in. diameter drill on the end-slide.

A roll on the cross-slide at the fifth position impresses lettering on the sparking-plug shell. An auxiliary spindle, running in the opposite direction to the work-spindle at this position, is equipped with a high-speed steel reamer. At the sixth position, the completed shell is cut off. Work-spindles are rotated at 1,440 r.p.m., providing a cutting speed of 350 ft. per min. Feed rates for the cross-slide tools vary from 0·001 in. per rev. for cutting off, to 0·014 in. per rev. for knurling. Tools on the main end-slide are fed at the rate of 0·0072 in. per rev., and the reamer on the auxiliary spindle at 0·0115 in. per rev.

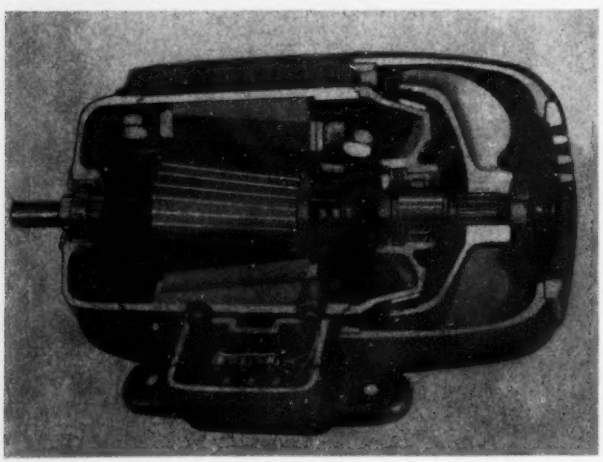
The adjustable, mechanical gauges shown in Fig. 5, are supplied by Federal Products Corporation, and serve for the inspection of nine different dimensions on the completed spark-plug shells. This checking operation requires only 1½ min. per part. The Jones & Lamson optical comparator with a 30-in. screen (Fig. 2) is provided with a frosted-glass chart, of 10× magnification, for inspecting the contour of the shells and checking the profiles of all the cutting tools.

Acrow-Demag Electric Motor with a Self-braking Action

The German-made Acrow-Demag electric motor, marketed by Acrow (Engineers), Ltd., 8 South Wharf, London, W.2, incorporates a tapered sliding rotor which provides a self-braking action when the current is switched off.

Referring to the accompanying cut-away view, the right-hand end of the rotor shaft carries a brake ring, the tapered bore of which has a lining of friction material, and there is a matching conical surface on the bearing housing attached to the body. When the current is switched off, the rotor and brake ring are moved to the left by a compression spring surrounding the shaft, so that the friction lining is brought into contact with the bearing housing, and the assembly is quickly stopped. When the current is switched on to start the motor, the rotor is moved to the right, into contact with a thrust bearing, by magnetic force, against the action of the spring. In consequence, the brake is released, and the rotor assembly can run freely.

The motor is available with a squirrel cage or slip ring rotor, and is particularly intended for use with machine tools for accurately controlling movements of slides, and for applications where frequent stopping and reversing is required.



Cut-away View of the Acrow-Demag Electric Motor which has a Sliding Rotor to Provide a Self-braking Action

Birlec-Ajaxomatic Duplex Melting and Feeding Unit for Cold-chamber Die Casting

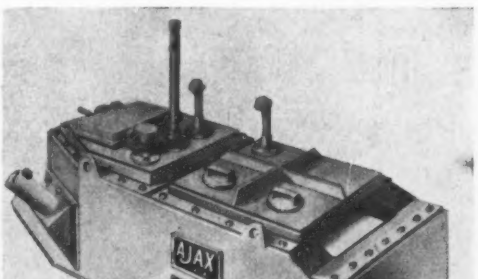
Details were given in MACHINERY, 90/1015—3/5/57, of a combined mains-frequency induction holding-furnace and feeding unit made under licence from the Ajax Engineering Corporation, U.S.A., by Birlec, Ltd., Tyburn Road, Birmingham, 24. This unit was a channel-type for aluminium alloys, from which molten metal was automatically fed to a die casting machine when pneumatic pressure was applied to the surface. It was necessary to charge the unit periodically with molten metal, and die casting was then interrupted.

Another furnace, which is now being built by Birlec, Ltd., under their agreement with the above-named company, is shown in the accompanying illustration. This unit provides for melting material, and automatically feeding a die casting machine. It incorporates a second chamber connected to the first by a narrow passage, and provided with a separate inductor capable of melting cold metal at a useful rate. In consequence, a separate external melting furnace is not required, and as metal transfer from the melting to the holding chamber is continuous, and automatic, there is no interruption of the casting process. The first of these units, it may be noted, was put into operation, commercially, in the U.S.A. in 1954, and since that time about 50 more duplex units have been installed.

The inter-connected furnace compartments are lined with virtually inert refractory materials, and the metal which is being melted does not come into contact with other metals. Each compartment is provided with a separate inductor unit, supplied with current from the mains, and an iron core concentrates the magnetic field produced. This field passes through part of the furnace charge, which acts as a short-circuited secondary winding of a transformer, and carries a heavy induced current for heating. The compartment into which the new material is charged, through the opening at the right-hand end, is powered by an inductor rated at 72 kW., and has a maximum melting capacity of 360 lb. per hour. A unit of larger size, with a capacity of 500 lb. per hour, is also available.

Ingot and scrap material may be charged into the melting compartment in amounts up to 200 lb. at a time without affecting the temperature of the metal in the holding compartment. For the latter, there is an inductor of 20 kW. capacity, in which the current flow is controlled by the temperature of the metal at any desired value. Thus, pouring of some aluminium alloys may take place at temperatures as low as 610 deg. C., for difficult casting operations. For pouring purposes, low pressure air, which is introduced above the charge, forces the metal out through an electrically-heated refractory-lined spout leading to the injection sleeve. The pouring operation is controlled electronically and compensation for changes in the level of metal in the holding section is made automatically.

Such variations may represent differences of several 100 lb. in the amounts of material in the furnace. Shot weights can be adjusted to values between ½ and 30 lb., and special units can be supplied with multiple pouring spouts for making several identical castings simultaneously by methods other than pressure die casting. The furnace is controlled by equipment installed in three separate cabinets which governs the operation of the melting, holding, and pouring units. An indication of the level of the metal in the furnace is afforded by a dial on the pouring control



Duplex Ajaxomatic combined melting, holding and pouring unit, made under licence by Birlec, Ltd.

cabinet so that charging may be carried out when required. Normally, the furnace controls are inter-connected with those of the die casting machine, which then functions on an entirely automatic cycle, initiated by a mechanism associated with that for closing the dies.

The furnace is efficiently insulated to ensure comfortable working conditions. Where the gates and sprues are trimmed from castings on a press installed near the die casting machine, scrap material can be directly returned to the melting furnace on a short conveyor.

Giddings & Lewis Tape-controlled Die Sinkers

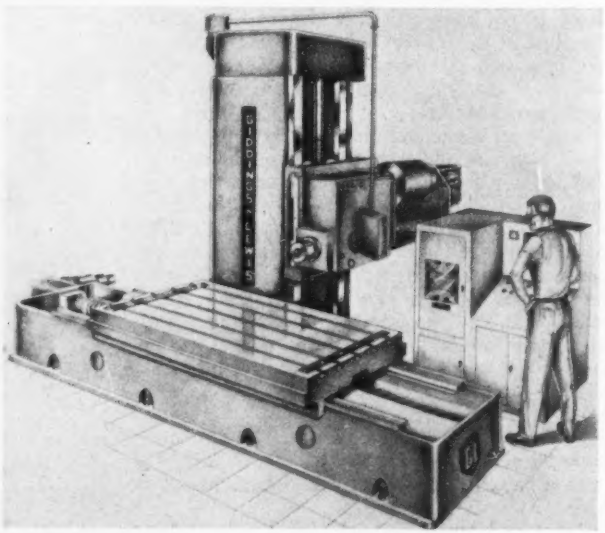
A range of tape-controlled die sinking machines has recently been introduced, under the name DiMil, by the Giddings & Lewis Machine Tool Co., Fond du Lac, Wisconsin, U.S.A. There are six sizes of table-type machines, of which the smallest, with a worktable measuring 36 by 48 in., is shown in the accompanying wash drawing. For work which is outside the capacity of this range, there are floor-type machines. Both types are equipped for control by means of the Giddings & Lewis Numericord continuous-path magnetic tape system, but provision is also made for manual control, by push-buttons, so that the machines can be used for general purpose work. All machines have quill-type milling heads, which may be equipped with either 10- or 20-h.p. motor drives, and the 38 spindle speeds range from 10 to 1,780 r.p.m. Each milling head has 18 in. of transverse adjustment on the column saddle, and the quill extension is 10 in.

A decimal indicator system is available to cover all three directions of motion, so that the exact position of the cutter can be determined at any time, and horse-power and feed rate meters are incorporated to enable cuts to be taken at optimum efficiency and to indicate when the cutter requires sharpening. When the tape is being prepared for a part involving cuts of long duration, information can be included regarding the points at which a sharpened cutter should be provided.

PRODUCING A LARGE HAMMER DIE

An indication of the savings which can be achieved with these machines is afforded by a record of the times required to produce a large hammer die. The total production time was 57 per cent of that for a conventional machine, working in conjunction with templates, and the actual machine time was reduced by 67 per cent. As a result of the improved finish and accuracy of the part, the time required for subsequent bench finishing work was reduced by 62 per cent. When a duplicate of the part was produced, the total manufacturing time was cut by 77 per cent, compared with 43 per cent for the prototype, since the programming and tape preparation were already completed. Once the tape has been prepared for a particular part, modifications can be made to that part, within certain limitations, without the need for altering the tape. For example, if it is required to change the draft angle on a die, the machine can be set up with the original tape, but with a cutter having a different draft angle, since the tape controls the path followed by the centre of the spindle.

Programming for the Numericord control system starts with the preparation of a methods planning



The smallest of the range of Giddings & Lewis DiMil tape-controlled die-sinking machines, which has a working surface of 36 by 48 in. Floor-type machines are also available

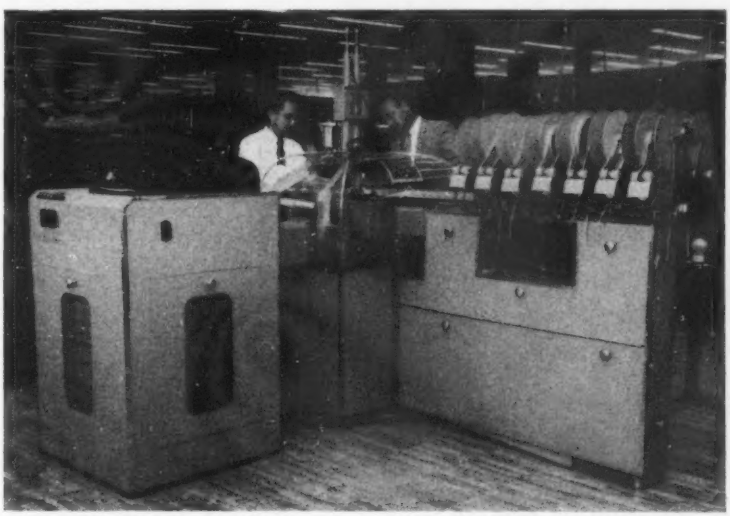
sheet, which includes a detailed list of the various operations in the required sequence, and other relevant information, such as the tools to be used, also spindle speeds and feed rates. This basic information is transferred to IBM cards, which are fed into an electronic computer to produce a manuscript and a number of punched cards. From these cards, a paper tape is produced which is ultimately employed to obtain the magnetic tape that controls the movements of the spindle and worktable, or, in the case of a floor-type machine, the spindle and the travelling column. A copy of the planning sheet is made for use by the operator, so that he may follow all the operations as they are performed.

Giddings & Lewis Machine Tool Co. are represented in this country by Rockwell Machine Tool Co., Ltd., Welsh Harp, Edgware Road, N.W.2.

Card-controlled Equipment for Assembling Components to Printed Circuit Boards

The equipment shown in the accompanying illustration was designed and constructed by International Business Machines Corporation, New York, U.S.A., for the automatic assembly of such components as resistors and capacitors to circuit boards for electronic calculating machines. Before this system could be employed successfully, a considerable degree of component standardization was necessary, and tubes, for example, are now of common size and shape, irrespective of their electronic characteristics. The equipment is designed to handle components with axial leads which are supplied in the form of "belts" wound on reels. To form the belts, the ends of the leads are secured to meshing tapes. A maximum of 20 reels can be accommodated and for each reel there is a cut-off unit.

Printed circuit boards up to 10 in. square can be handled, and the component leads are inserted in holes which are spaced 0·7, 1·0, or 1·4 in. apart. Punched cards are employed to control the operation of the equipment and there is a 2-directional servo system for positioning the circuit boards to receive successive components. The card control system provides for the selection of the required type of component. One part is then severed from the appropriate reel by the cut-off unit and falls into a V-shaped trough, along which it is propelled by air pressure. When it reaches the insertion head its presence is detected by a photo-cell. In the meantime, the circuit board has been positioned to receive the part, and the signal from the photo-cell initiates the lead forming, inserting, and clinching cycle. The equipment can be readily changed over for assembling components to circuit boards of different types.



Equipment for automatically assembling components such as resistors and capacitors to printed circuit boards for electronic calculating machines (by courtesy of International Business Machines Corporation and I.B.M. United Kingdom, Ltd.)

Jackson & Bradwell Direct-indicating Static and Dynamic Balancing Machines

An electronic vertical-spindle balancing machine of the latest type produced by Jackson & Bradwell, Ltd., Grove House, Sutton New Road, Birmingham 23, is shown in Fig. 1. This machine, which is intended for balancing disc-shaped components, such as flywheels, in one plane only, is fully automatic, and affords direct indications of the position and amount of the unbalance. The work is placed on a circular table, on which it is located by a central spigot, and when a pedal is depressed, the table and work are driven at the required speed. Rotation continues for a predetermined period, sufficient to ensure that steady readings are obtained on the amount and position indicating instruments, seen in Fig. 1. These readings are then "locked," and the machine stops.

The amount scale is calibrated in arbitrary units, which are suitably related to the weight-system employed, by the initial adjustment of a "set" control, and the location of the unbalance is ascertained by transferring the reading from the position instrument, to an angular scale on the periphery of the table. An adjustable process timer controls the duration of the automatic cycle, and when the next cycle is initiated, the instrument pointers are released to take up fresh positions. In another version of the machine, a drilling head, mounted on the top of the cabinet, is employed to compensate for unbalance without removing the work from the table.



Fig. 1. Jackson & Bradwell electronic direct indicating vertical balancing machine, for disc-shaped components requiring correction in one plane only

HORIZONTAL MACHINE

The operating principles employed in the vertical-spindle unit described have also been embodied in the company's latest design of horizontal dynamic balancing machine, shown in Fig. 2 and 3. On this machine, the system of work suspension, drive-transmission, and electrical pick-ups for the various measuring impulses, are substantially the same as those employed on earlier types, to which reference has already been made in MACHINERY, and the main differences are in the arrangement of the electronic equipment. The automatic cycle is now as follows. Once the component has been loaded on the support-rollers, and coupled to the small, universally-jointed drive shaft, a "start" button is pressed, and the work is rotated at a suitable speed.

Direct indications of the amount and angular position of any unbalance in the left-hand correction plane are given by the two instruments seen at the left of the panel in Fig. 3, and the readings are locked after a suitable stabilizing period. Thereupon, the two right-hand instruments are energized, and, similarly, the readings for the right-hand correction plane are obtained, and locked. The machine then stops, and the work is rapidly arrested by an automatic brake. This brake is released by means of a manual switch to the left of the main instrument panel (Fig. 3) and the work is rotated, by hand, until an angular scale on the main driving spindle gives a reading, against a fixed pointer, corresponding to that on one of the two position instruments. The position of the unbalance is defined by a convenient

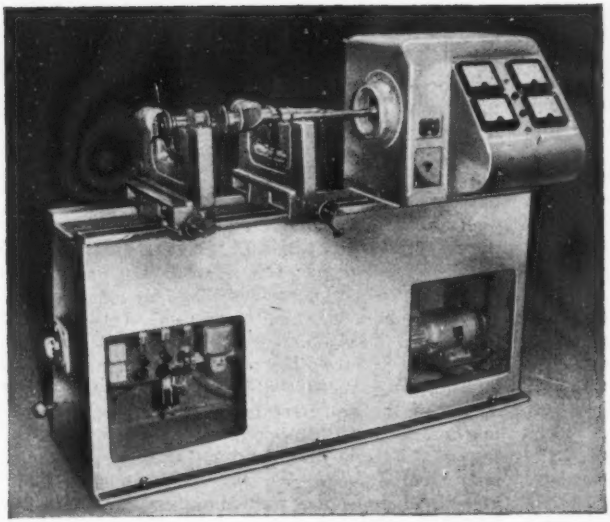


Fig. 2. Latest-type Jackson & Bradwell direct indicating horizontal balancing machine, with covers removed to show (left) the electronic equipment and (right) the driving motor

reference-plane—usually that across the tops of the carriage supports—and the latter are provided with flat datum pads, for this purpose.

ELECTRONIC EQUIPMENT AND CONTROLS

The electronic equipment comprises a power unit, an amplifier which controls the amount indications, and an angle unit for the position indications. To eliminate "parasitic" frequencies, which might be picked up from the support rollers, the drive system, or the shop floor, a filter network is incorporated in the amplifier. This network ensures that only those frequencies that result from unbalance are amplified and fed to the indicating instruments, and is of a readily-replaceable unit type. The amplifier circuit incorporates trimming controls, for the initial adjustment of "gain" (amplification), "tune" (frequency selection), and "sensitivity" (response of pick-up to unbalance).

Trimming controls for "scale width" and "symmetry" are also provided in the angle unit, which, in effect, is a timer for measuring the interval between a constant datum position in each revolution of the work, and the peak effect of the unbalance. As a further safeguard against the unintentional introduction of parasitic frequencies, into the amplifier and angle circuits, the power unit is of a type that provides a smooth D.C. supply. A further item of equipment is a small chassis which carries a set of relays. These relays control solenoids incorporated in the indicating instruments, which serve to lock the readings. The adjustable process timer, whereby the automatic cycle is pre-set, is mounted on the same chassis.

As may be observed in Fig. 3, three controls are mounted on the main panel, between the two pairs of indicating instruments. The control at the bottom of the group is a 3-position selector switch, with settings marked "A," "R" and "L." The "A" setting is employed when it is desired to operate the machine on the fully-automatic cycle described, and "R" (right) and "L" (left) are used during initial calibration. At either of the latter two settings, the corresponding indicating instruments are energized, and readings for either correction plane may thus be obtained at will, at any time during the calibrating procedure.

The third control, at the top of the group, is a push-button, which, when depressed, moves the datum-point for angular position of unbalance through 180 deg. This control is used only in the comparatively unusual event of the position of the unbalance coinciding with the datum. When such coincidence occurs, the position of the unbalance

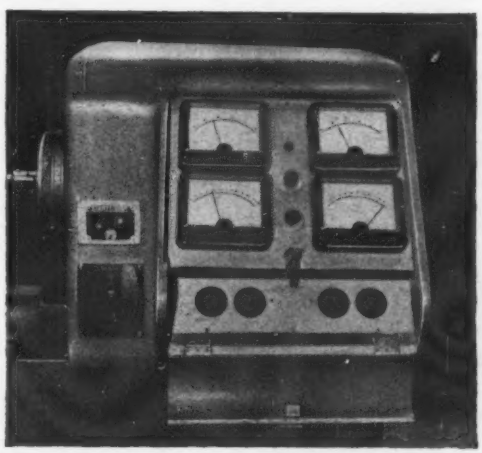


Fig. 3. Close-up view of the main panel, showing the instruments and controls

is, in effect, both at 0 deg. and 360 deg. to the datum. Since, on the indicating instrument, 0 deg. and 360 deg. are at opposite ends of the scale, the pointer oscillates from one end of the scale to the other. When the button is depressed, the pointer takes-up a stable position near the centre of the scale, at 180 deg. to the original datum. Due allowance for this 180-deg. shift must, of course, be made when transferring the reading to the work.

CALIBRATING THE MACHINE

Referring again to Fig. 3, it will be seen that there are two additional controls immediately below each pair of instruments. These controls, which are also employed for initial calibration and setting, are mounted in a recess with a hinged cover (seen open) fitted with a Yale-type lock. This cover is normally kept closed and locked, to prevent unauthorized interference with the settings. Each pair comprises a "set" control, the function of which has already been described, and a "feed" control for cancelling out, in one correction plane of the work, the transmitted effects of unbalance in the other.

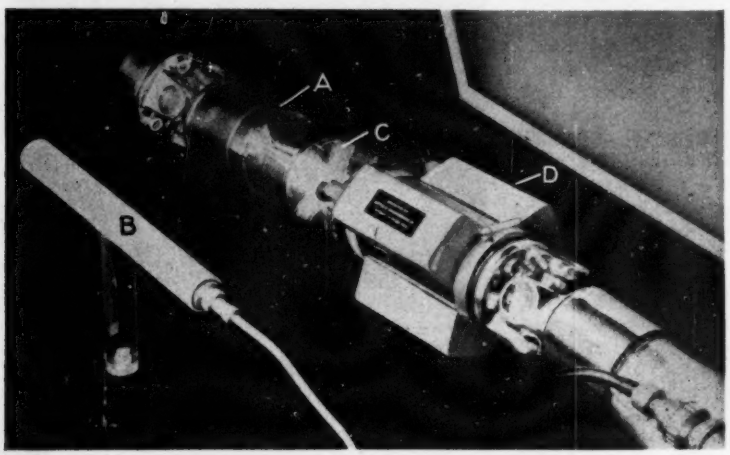
Calibration may be carried out either by using a physically balanced component, or, on machines provided with the necessary optional equipment, an "electrically" balanced component. Machines so equipped have provision for initially cancelling out, by electrical means, any indications which may be obtained from a component not necessarily in true dynamic balance. With either method, a known weight is applied in one of the correction planes, and the machine is switched to give readings for the second plane. Any reading of unbalance, transmitted from the applied weight, is neutralized by means of the "feed" control, and the machine is stopped, and the weight transferred to the second plane. The neutralizing procedure is then repeated, for the first plane.

Next, without stopping the machine, it is switched to read in the plane in which the weight has been applied, and the appropriate instrument is adjusted to give the required amount reading, by means of the corresponding "set" control. The machine is again stopped, the weight is transferred back to the first plane, and the corresponding instrument is set to give the correct amount reading. The procedure for calibrating the vertical-spindle machine (Fig. 1) is generally similar, but is considerably simplified by the fact that there is only one correction plane.

On both types of machines, servicing of the electronic equipment is readily effected by removal and replacement of the various units, all of which are provided with plug-type connections.

Birfield Inductive "Coupling" for Test Rigs

The accompanying figure shows a close-up view of part of a test rig which has been developed by Birfield Engineering, Ltd., a member of the Birfield Group of Companies, for investigating the effects of changes of torque on a propellor shaft incorporating Hardy Spicer joints. For such tests, involving rotating parts, the connections between the latter and the various in-



The Birfield inductive "coupling" applied to a propellor shaft for investigation of the effects of changes in torque. There is no mechanical connection between the rotating shaft and the test instruments

struments employed to indicate the results are normally made by means of slip rings and brushes, but this method has certain inherent disadvantages. Firstly, the electrical contact between the rings and the brushes is subject to interference due to the presence of oil, dirt, and moisture, and, secondly, it can be affected by mechanical conditions such as vibration and eccentricity.

To overcome these problems, the company has developed an inductive "coupling," which eliminates the need for any mechanical connection between the part under test and the associated instruments. Basically, the coupling consists of a coil of wire wound round the rotating shaft, as at *A*, and a stationary pick-up coil mounted to one side of the latter, as at *B*. During the test, signals are transmitted from the strain gauges *C* to miniature electronic equipment and batteries housed in the three casings *D*, whence they are amplified and transmitted to the coil *A*. These signals set up a magnetic field in the coil, thereby causing a voltage to be generated in the pick-up *B* which is in proportion to the strength of the signals. The pick-up coil is connected to an oscilloscope by way of the white cable seen in the foreground.

To provide for changes in torque in the shaft under test, the drive is taken through a Laycock-de Normanville overdrive unit, the ratio of which can be changed by means of a control switch. It is stated that no special machining or alteration is required to parts which are tested with this equipment, indeed it is often unnecessary to dismantle the assembly, since the coil *A* can be wound on to the shaft *in situ*.

Adaptable Set-up for Machining Both Ends of Motor Frames

For simultaneously machining both ends of motor frames, an adaptable tooling set-up is employed on a Gisholt No. 12 automatic production lathe at the works of the Valley Electric Corporation, St. Louis, Missouri, U.S.A. The tooling can be arranged either for turning or boring to obtain external or internal rabbet fits, and 18 sizes of three different types of frames can be accommodated, which have 11 different bore diameters and may be of either steel or cast iron.

A typical set-up for this operation is shown in Fig. 1. The motor frame is placed on an expanding mandrel mounted on the spindle nose. To provide for variations in the length, spacers are employed on the arbor, and for different bore sizes there are interchangeable expanding bushes. A frame is positioned with one end against an air-operated, headstock-mounted retractable locator. The air-operated tailstock is mounted on the front carriage, and is positioned longitudinally by movement of the carriage towards the headstock. A ball bearing bushing carried on the tailstock quill is advanced to support the forward end of the mandrel arbor, and a draw-bar,

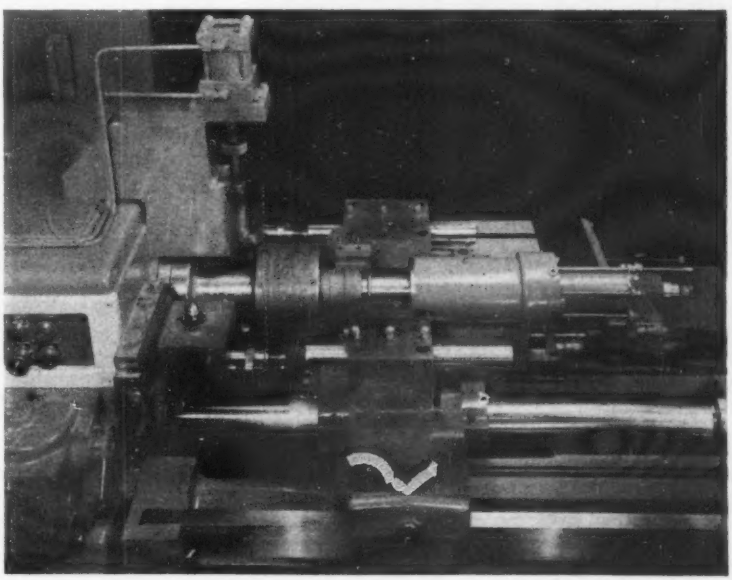


Fig. 1. Adaptable set-up on a Gisholt No. 12 automatic production lathe for machining both ends of motor frames

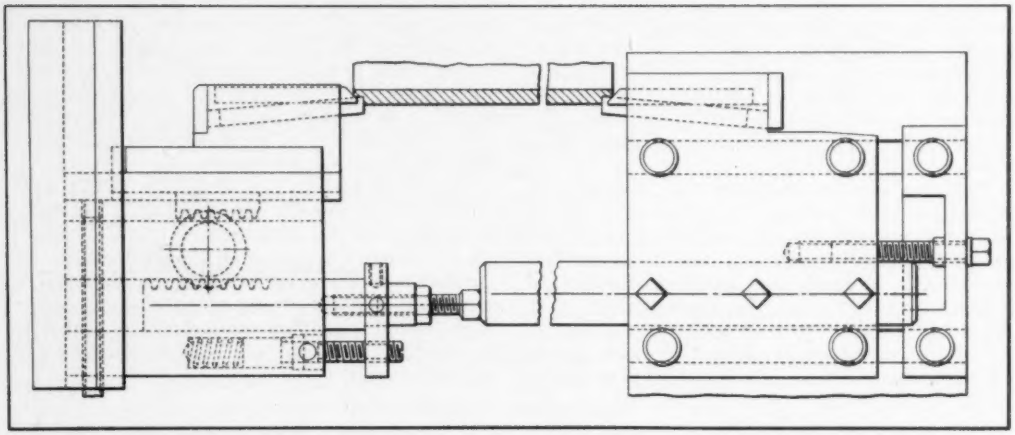


Fig. 2. A plan view of the front tooling for the set-up in Fig. 1, showing the method of operating the auxiliary slide on the headstock through rack and pinion

extending through the spindle, serves to expand the mandrel to hold and to drive the work.

In addition to the tool slide on the front carriage and the rear independent slide, two auxiliary slides are mounted on the headstock, one on either side of the spindle. When the front slide moves towards the headstock, a pusher bar on the front tool block contacts a plunger to operate the front auxiliary slide and feed the tools into the work. Movement is transmitted to the auxiliary slide through racks and pinion as seen in the line drawing, Fig. 2. The rear auxiliary slide is operated in the same manner by movement of the rear independent slide.

Cutting tools on the rear block rough turn, face and chamfer the inner edge of the outer end of the motor frame, while tools on the rear auxiliary slide perform the same operation at the opposite end of the work. Next, the front slide is fed towards the headstock to finish machine the outer end of the work. At the same time, the opposite end is finished by the front auxiliary slide.

Change-over for machining different sizes of motor frames, or for boring instead of turning rabbet fits, is comparatively easy and occupies only about 30 min. for similar frames. It should be noted, however, that when changing from "single end" frames to those which require both turning and boring operations at each end, the time required is somewhat longer.

The average floor-to-floor time for machining all the sizes of frames which are handled with this set-up is approximately 1 min.

Electro-chemical Machining Process Developed by Elox Corporation

It is reported in *Mechanical Engineering* that the Research Division of Elox Corporation, Royal Oak, Michigan, U.S.A., has developed an electro-chemical machining process which enables metal to be removed economically at comparatively high rates. An electrode, similar to that employed for electrical discharge machining, together with the workpiece is submerged in a saline solution and metal is removed by an electro-chemical action, the operation being controlled by a sensitive servo-feed system, whereby the electrode is automatically advanced as machining proceeds. It is stated that the gap between the electrode and the workpiece, which determines the accuracy of the result obtained has a minimum value, at the present stage of development, of 0·015 in.

Very heavy currents can be employed, for example, within the range from 500 to 50,000 amp. With a minimum electrode area of 100 sq. in. and a current supply of 5,000 amp., a metal removal rate of the order of 30 cu. in. per hour is obtained, and with a current of 50,000 amp. and a minimum area of 1,000 sq. in., the figure is increased to 300 cu. in. per hour. Any conducting material, including lead, tin, zinc, or solder can be employed for the electrode, which can therefore be cheaply produced and has a long life. The machines are said to be safe and simple to operate, and little training is required.

New Production Equipment

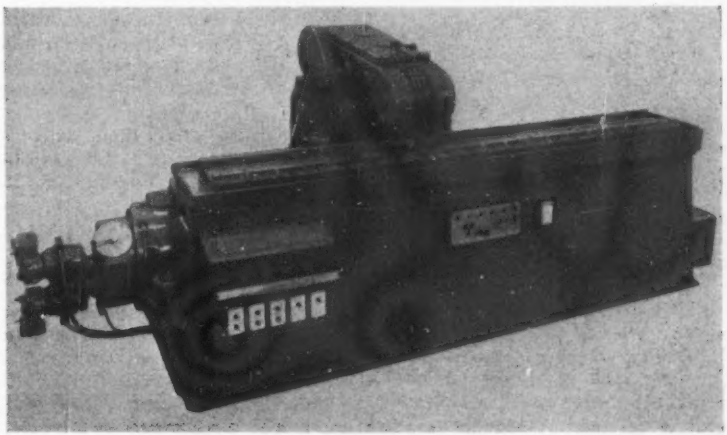
Binns & Berry Electronically-controlled Automatic Rack Milling Machine

Binns & Berry Bros. (Halifax), Ltd., Ovenden, Halifax, are building three electronically-controlled automatic rack milling machines for their associates, Halifax Rack & Screwcutting Co., Ltd., and the accompanying illustration shows the first of these machines. Face widths may range up to 8 in., and racks up to 10 ft., long can be cut at one setting. Where greater lengths are required, the work can be re-set. Teeth from 1½ to 16 d.p., and the corresponding circular, metric and module pitches can be milled. There are nine cutter arbor speeds from 37·5 to 247·25 r.p.m., and nine rates of feed from ⅜ to 7 in. per min.

A feature of the machine is a dekatron controlled-pitch dividing unit with signal lights, supplied by Lancashire Dynamo Electronic Products, Ltd., Rugeley, Staffs, and seen mounted at the left-hand end of the bed. By means of dials on the unit, the linear dividing movement required can be set to five decimal places, and it is stated that the theoretical error in the movement on the machine for each setting does not exceed 0·00002 in. No gear ratios are involved in the division, and metric pitches can be readily accommodated by converting the pitch measurement into inches and setting on the dials. Movements are obtained by means of an accurate dividing screw, which is driven by high and low speed motors, seen mounted at the end of the bed.

The machine can be employed for either climb or conventional milling, with a 6-in. diameter single cutter. During the cutting traverse, the saddle is locked hydraulically, and all the sliding movements of the machine, and cutter relief during the return stroke of the head, are also hydraulically-operated by oil at a pressure of 1,000 lb. per sq. in. The box-section bed has an inclined double-shear slideway at the rear for supporting the saddle, which carries the ram-type traversing cutter head, and the troughed bed top is equipped with a vice for holding the racks to be cut.

Drive to the cutter arbor is taken from a 7½-h.p. motor through nickel-chrome steel spur gears, and the arbor is mounted in two pairs of Timken roller bearings. A 1¾-h.p. motor provides the forward feed and return traverse to the cutter head ram, which moves in guideways with hardened and ground steel inserts. Drive for the forward traverse is transmitted through spur reduction gears to a worm wheel which acts as a nut on the feed screw, and for the return traverse, at 6 ft. per min., the screw is rotated through the worm wheel with the forward traverse still engaged. Electric



Binns & Berry Bros. automatic rack cutting machine with dekatron controlled pitch dividing unit

trips are set to determine the length of the forward and return strokes.

On the return stroke of the ram, the cutter head is raised 1 in. by a hydraulically-actuated bar mechanism for relief of the cutter, and the dividing mechanism can only come into operation with full relief and at the end of the stroke. During dividing, the feed traverse cannot be operated. After dividing has taken place, the cutter head is returned to its cutting position and the forward feed traverse is started. For initially setting the depth of cut, there is a handwheel graduated in increments of 0·001 in.

Electric limit switches are fitted to prevent overrunning and there are safeguards to ensure that the dividing mechanism cannot be operated if there is any obstruction, and that the cutting traverse will not function unless the cutter head has been brought to the correct position. It is necessary for the dividing clutch to be disengaged by hand lever before the saddle can be rapidly traversed on the bed.

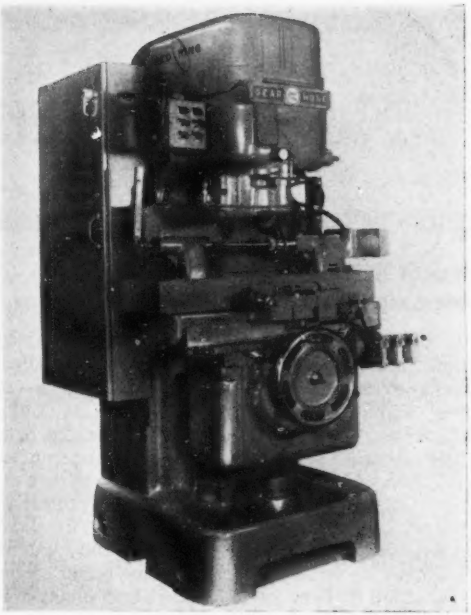
A push-button panel for operating the various motors and a recording ammeter are mounted on the front of the bed. Coolant is supplied to the cutter by Norgren Spraylube equipment.

Red Ring Dual Method Gear Honing Machine

The type GHB Red Ring gear honing machine, here shown, has been introduced by the National Broach & Machine Co., Detroit 13, Mich., U.S.A., for honing the teeth of hardened gears by either the "constant pressure" or "zero backlash" methods. There are two sizes of machine, one for gears up to 8 in., and the other for gears up to 12 in., pitch circle diameter, and both can be supplied with manual, semi-automatic, or fully-automatic work loading arrangements.

On the GHB machine, a workpiece is held between the centres of a headstock and an air-operated tailstock, and these units are mounted on a tilting table, of patented design, which is hinged, at the rear, to the longitudinally-reciprocating main work-table. The tilting table is lowered by means of an air cylinder to facilitate loading and unloading the work.

If it is required only to remove nicks and burrs on the teeth and to improve the surface finish, the "constant pressure" method of honing is adopted. Then, the table is raised by the air cylinder and a constant-pressure valve is actuated, so that the teeth of the gear are brought into tight mesh with the honing tool. The honing tool takes the form of an abrasive-impregnated, plastics gear, and the controlled-pressure, tight-mesh condition is maintained throughout the honing operation, with slight variation of the centre distance.



Red Ring dual method gear honing machine

When it is necessary to correct the tooth-form of hardened gears, the "zero backlash" method is used. Then, the tilting table is raised by the air cylinder to engage the work with the tool at the centre distance which ensures that there is no backlash, and the table is locked in this position by another air cylinder. This work-tool centre distance is maintained throughout the honing operation.

Red Ring machines are distributed in this country by Charles Churchill & Co., Ltd., Coventry Road, Birmingham, 25.

Craven Type E Vertical Turning and Boring Mill with Electrical Copying Equipment

Shown in the accompanying figure is the type E heavy-duty vertical turning and boring mill which has been introduced in 5-ft., 6-ft., and 7-ft. sizes by Craven Brothers (Manchester), Ltd., Reddish, Stockport. Electrically-operated profile copying equipment of a robust and relatively simple design, has now been developed by the company, and is fitted on the left-hand saddle of the machine illustrated.

Two saddles, each provided with a balanced steel ram of octagonal cross-section, are mounted on the cross rail, and the latter has power adjustment under push button control, and can be securely locked in position. In addition, a side tool head can be fitted on the right-hand column, if required.

On the 6-ft. machine, the height admitted under the cross slide is 4 ft. 9 in., and under the toolholders, 4 ft., and the vertical travel of the rams is 2 ft. 6 in.

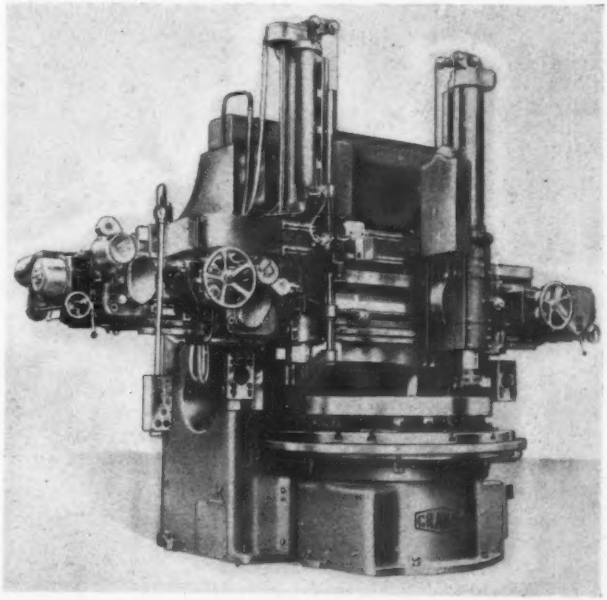
The table is supported on the bed by a V-section, white-metal lined, annular track, and is attached to a large-diameter spindle running in plain bronze bearings, with oil bath lubrication. For flood and pressure lubrication of the annular track, with filtered oil, there is a pump which operates only when the table is rotating. The main drive is taken from a 30-h.p. motor through a 12-speed gearbox, with final transmission by a steel pinion which meshes with an external spur gear ring secured to the underside of the table. Control of the table motor for starting, stopping and inching is by push-button switches only, as there is no friction clutch in the drive, and the speed-change levers for the gearbox are conveniently located at the front of the machine. The twelve table speeds for the 6-ft. machine range from 1·75 to 35 r.p.m.

Horizontal feed to each saddle, and vertical or angular feed to the ram, are obtained from independent variable-speed motors of ¾ h.p. on the end of the cross slide, the necessary D.C. supply for these two motors being obtained from magnetic amplifiers. Separate, constant-speed A.C. motors of 2 h.p. are provided for rapid traverse in all directions. Three ranges of saddle feed, from $\frac{1}{32}$ to $\frac{3}{8}$ in., $\frac{3}{32}$ to 1¾ in. and ¼ to 5 in., are provided through a gearbox, and the feed in each range can be varied steplessly for each saddle, under finger-tip control, by means of two rheostats on the cross slide.

Control stations at both sides of the machine incorporate push-buttons for controlling the main motor, together with forward, reverse and stop buttons for the appropriate feed motor, and separate forward and reverse rapid-traverse buttons for the rams and saddles. The right-hand saddle can be employed for taper turning, for which purpose the vertical and horizontal feed motions are combined through change wheels carried on a swing frame at the end of the cross slide.

The profile copying equipment, applied on the left-hand saddle, is entirely electrical in operation, and does not incorporate any electronic valves. The horizontal motion of the saddle, and the vertical movement of the ram required to produce the profile are effected by separate variable-speed D.C. motors controlled, through magnetic amplifiers, by a sensitive stylus unit on the ram, which engages a flat template on the cross rail.

Rate of feed vertically and horizontally is normally controlled automatically by the contour of the template, but provision is made for hand regulation, for use when particularly difficult cutting conditions are encountered. Push-button controls provide for rapid approach of the tool to the work, with automatic engagement of the copying feed, momentary withdrawal of the tool, for inspection purposes for example, and retraction of the tool followed by stopping of all motions. Warning lights give notice of any excessive stylus deflection, and indicate that the equipment is ready for copying, or that the copying motion has started. Convenient hand adjustment is provided for the initial setting of the stylus and template.



Craven type E heavy-duty vertical turning and boring mill fitted with electric profile copying equipment. The machine is available in 5-ft., 6-ft. and 7-ft. sizes

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One of these type E machines was demonstrated at the machine tool exhibition held in Milan from September 11 to 20.

Mössner Rekord Type SSF 950 Bandsawing and Filing Machine

The Rekord type SSF 950 heavy-duty bandsawing and filing machine, shown in the figure, is the largest size in the range made by the German firm



Mössner Rekord type SSF 950 bandsawing and filing machine

of Mössner. It has a throat depth of 37 in., and will handle work up to 15¾ in. thick.

Drive is taken from a 5½-h.p. motor, and the saw speeds can be varied steplessly from 50 to 3,000 ft. per min., by means of a conveniently placed handwheel, a direct reading dial being fitted to facilitate setting. In addition, a saw speed of 7,700 ft. per min. is provided, to permit friction sawing to be carried out on steel plates up to ¾ in. thick. The 194-in. long saw blade passes round a 20-in. diameter wheel in the base, and two 16¾-in. diameter wheels in the upper part of the frame. One of the smaller wheels can be tilted and adjusted for height, for tracking and setting the tension of the blade. Interchangeable tungsten carbide tipped guide pieces for saw blades of different widths are provided, and the roller guides run on ball bearings.

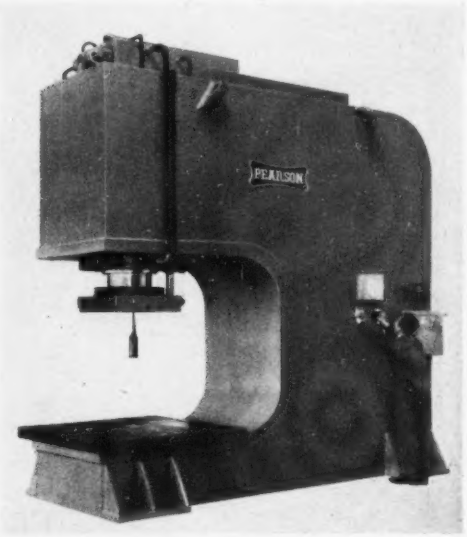
The 31½- by 29½-in. work table can be tilted through angles up to 15 deg. to the right and 10 deg. to the left, by worm gearing, and may be power traversed on ball-bearing guideways through a maximum distance of 11 in. by a separate motor. The traversing speed of the table can be varied steplessly by means of a knob. A fixed table with a 17¾- by 17¾-in. top surface is provided between the column and the main work table for supporting fairly long parts. Mounted on the column is a grinding attachment and a butt welder which will handle saw blades up to 1 in. wide. The machine weighs approximately 27½ cwt., and occupies a space of 73 by 43 in.

Elgar Machine Tool Co., Ltd., have recently been appointed sole agents in this country for the Mössner range of bandsawing and filing machines.

Pearson 500-ton General-purpose Gap-type Press

A 500-ton, general-purpose, gap-type press, as shown in the accompanying illustration, has recently been built for a Scottish shipyard by T. B. Pearson & Sons, Ltd., Walker, Newcastle-upon-Tyne. It has a welded steel main frame of box-type construction, and the daylight between the table and ram is 45 in., and the distance from the ram centre line to the back of the gap, 50 in. The T-slotted table measures 60 in. square.

Drive is taken from a 50-h.p. continuously-rated, squirrel-cage motor, controlled by a star delta

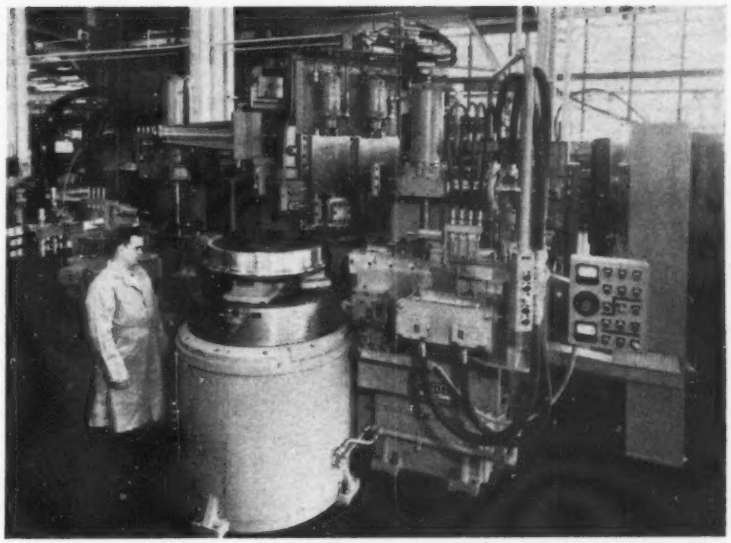


Pearson 500-ton general-purpose gap-type press

starter. The motor is directly-coupled to a multi-cylinder, radial-type pump designed to supply a large volume of oil at low pressure for the rapid approach of the ram, and a small volume at high pressure for the operational stroke.

Push-button controls are conveniently arranged on a swinging arm pendant to permit full control of the press from any position near the table. A hand control on the side of the frame enables the total force exerted by the ram to be pre-selected and set at 100, 300 or 500 tons. There is also a hand control for regulating the speed of approach to suit requirements. The main control valve is operated by a small electrically-driven servo pump and two solenoid valves which are controlled by the push-buttons on the pendant.

The floor space occupied by the press is 13 ft. 8 in. by 5 ft. 8 in., the overall height, 14 ft., and the approximate weight, 45 tons.



Snyder facing and profile turning machine for railway wheels

Snyder Facing and Profile Turning Machine for Railway Wheels

The machine here shown has recently been built by the Snyder Tool & Engineering Co., Detroit, Michigan, U.S.A., for performing facing and profile turning operations on railway wheels from 33 to 42 in. diameter, with weights up to 7¼ cwt.

Steplessly-variable table speeds from 20 to 80 r.p.m. are provided by an electronically controlled D.C. motor of 125 h.p., the drive being transmitted by V-belts and spiral bevel and helical gears. A floating hold-down post at the centre of the table incorporates a number of jaws which are expanded hydraulically to engage with the cored axle bore and pull the wheel into contact with three support pads. At the same time, the wheel is gripped by three hydraulically-operated equalizing jaws, which engage with the reduced diameter at the flange side.

The saddle on the cross-rail incorporates two vertical slides, one of which carries cutting tools for rough- and finish-facing the hub. Three cutting tools are mounted in the second slide for rough- and finish-facing and forming a radius on the rim.

The left-hand side head has a template-controlled hydraulic copying slide and carries a single cutting tool for turning the tapered tread portion on the wheel. For this operation, vertical feed is applied to the head at a constant rate. Hydraulic copying equipment is also incorporated in the right-hand side head, and there are two cutting tools, one of which provides for turning the throat radius and part of the flange radius. The remainder of the latter radius is turned, and the flange is faced, by the second tool. Cutting feed is applied vertically to the right-hand head at a variable rate.

These operations are performed, without coolant, in a cycle time of 2¼ min. A cutting speed of 250 ft. per min., and a feed, for both turning and facing, of 0·065 in. per rev. are employed.

The tracer heads of the copying equipment can be quickly set for turning wheels of three different diameters within the capacity of the machine. Different settings for the travel of the facing slide can also be rapidly obtained, to ensure smooth blending of the radius between the rim and the tread for wheels of different diameters. The depth of cut for facing can be varied in steps of $\frac{1}{16}$ in.

Hydraulic counterbalancing is provided for the cutter heads, and they are operated by hydraulic cylinders of fairly small diameter, to which pres-

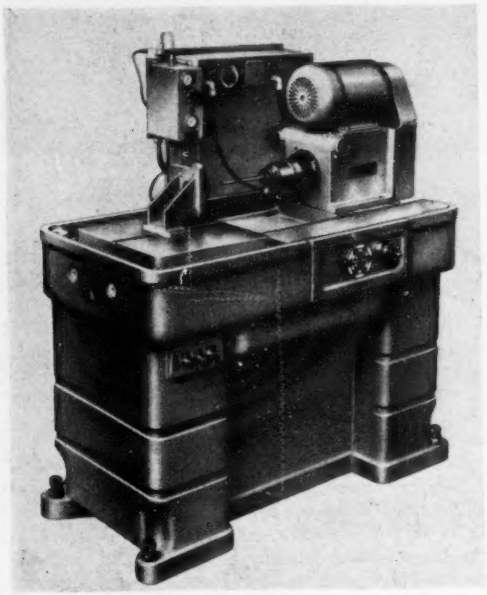
sure fluid is supplied at 1,000 lb. per sq. in. Six pumps are incorporated in the hydraulic unit, and are driven by two motors of 15 and 20 h.p.

The machine weighs 55 tons, and occupies a floor space of 15 ft. by 17 ft.

Gaston E. Marbaix, Ltd., Devonshire House, Vicarage Crescent, London, S.W.11, are the sole agents in this country for the Snyder Tool & Engineering Co.

British-built Micromatic Hydrohoner Type 150 Honing Machine

A. A. Jones & Shipman, Ltd., Narborough Road South, Leicester, have recently started to build, under licence from the Micromatic Hone Corporation, Detroit, Michigan, U.S.A., the Hydrohoner type 150 horizontal-spindle honing machine, as shown in the illustration.



The Micromatic Hydrohoner type 150 horizontal-spindle honing machine, which is being built under licence by A. A. Jones & Shipman, Ltd.

The machine has a capacity for honing bores up to 1½ in. diameter, and the maximum stroke of the spindle head, which is reciprocated hydraulically on the bedways, is 12 in. The steplessly-variable traversing speeds available range from 0 to 60 ft. per min. Drive to the honing spindle is taken from a 1-h.p. motor, through a variable speed belt system, and a separate, 2-h.p. motor drives the hydraulic pump. A bridge-type carrier for work-holding fixtures is mounted on the 17- by 6-in. table, which is surrounded by a coolant trough. The distance between the centre line of the spindle and the table is 5 in.

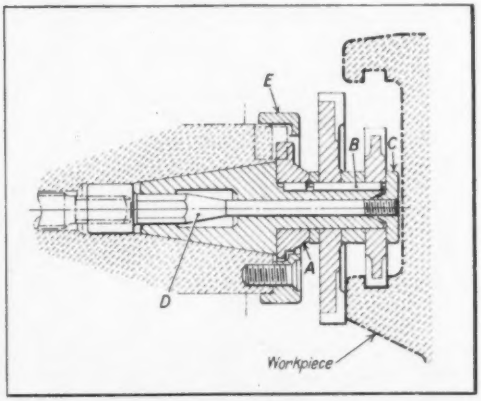
Expansion and collapse of the hone, at the beginning and the end of the working cycle, are effected hydraulically, and radial adjustments of the stones, to apply the cut and to compensate for wear, are made by hand. Alternatively, provision can be made for automatic adjustment of the stones by the Microdial hydraulic system. The Microsize gauging equipment, which may incorporate a plug or ring gauge, and provides for automatically stopping the machine when the required workpiece diameter has been obtained, can also be fitted if required. Since the machine is of the horizontal-spindle design, various types of work-handling equipment can be employed to give fully-automatic working cycles.

The machine weighs approximately 1 ton 11 cwt., and the single-piece bed occupies a floor space of 34 by 52 in.

J. & S. Lunzer Drawlock Arbor for Milling Cutters

The patent drawlock arbor recently added to the J. & S. Lunzer range, marketed by A. A. Jones & Shipman, Ltd., Narborough Road South, Leicester, is intended for use with shell-type end mills and side-and-face, and face-milling cutters.

The accompanying sectional view shows the new arbor fitted with two cutters for performing simul-



Sectional view of the J. & S. Lunzer drawlock arbor fitted with two cutters for performing slot and face milling operations simultaneously

taneous slot and face milling operations. A shrunk-on ring *A*, of hardened and ground steel, surrounds the reduced-diameter portion of the arbor, and has a pair of slots to engage the driving dogs normally fitted to the nose end of the cutter spindle. The milling cutters are set at the required distance apart by a spacing collar of a conventional type, and drive from the arbor is transmitted by the key *B*. The cutters are clamped endwise by the special nut *C*, on the right-hand end of the drawbar *D*. This bar can move axially, but is prevented from turning in the central bore of the arbor. The left-hand end of the drawbar is internally threaded to receive a drawbolt which passes through the bore in the cutter spindle. Clamping and release of the cutters is effected by a nut on the drawbolt at the rear end of the spindle, which is usually readily accessible.

With this arrangement, the need for a clamp at the nose end of the arbor is avoided, and the form of the nut *C* enables the right-hand cutter to be set within ⅜ in. of a vertical face on the workpiece. The nut has a cone-shaped boss on its inner face to provide a fairly long internal thread for engagement with the drawbar *D*. When cutters must be changed frequently, the arbor may be held by the light-alloy cover *E*, which is passed over the ring *A* and secured to the spindle nose by screws.

When shell end mills and face milling cutters are to be employed, the key *B* is removed, and a separate sleeve of hardened and ground steel (which is not shown) is passed over the reduced-diameter end of the arbor. This sleeve has a fixed key which enters the keyway in the arbor, and dogs, formed integral with one end, engage the slots normally provided in the milling cutter, for transmitting the drive. Clamping of the cutter is effected by the nut *C* and the drawbar *D* in the manner already described.

The arbor and accessories are available as separate items, and are supplied in a steel box which has recesses to take the various parts.

P. & W. Type A Lead Tester For Screw Threads

The type A electro-mechanical instrument, here shown, has recently been introduced by the Pratt & Whitney Co., Inc., West Hartford, Connecticut, U.S.A., for checking parallel and taper internal and external screw threads up to 16 in. diameter, for both lead and taper, on components which may weigh as much as 500 lb. The minimum diameter of internal threads that can be checked is 1¼ in.

Measurement is effected by the company's well-known Electrolimit gauging system, and readings



Pratt & Whitney electro-mechanical instrument for checking screw threads for lead and taper

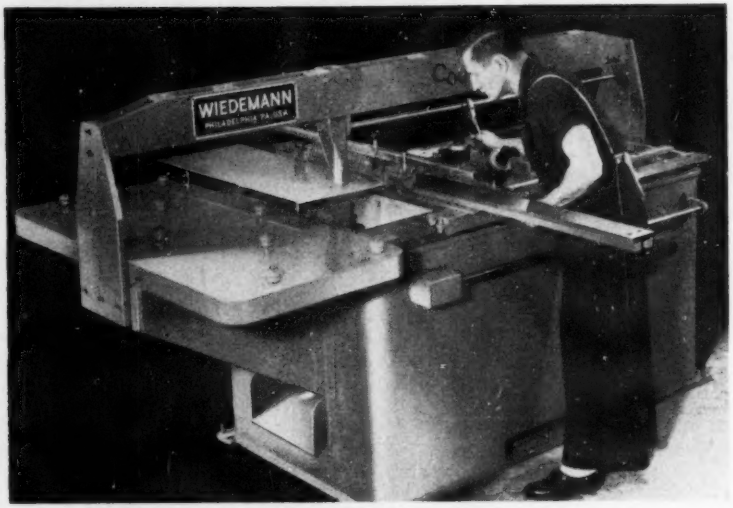
down to 0·00002 in. for lead and 0·0001 in. for taper may be obtained simultaneously or independently on separate dial-type instruments. Zero settings are made with slip gauges, and for taking measurements a ball-type stylus is brought into contact with the work. Interchangeable measuring spindles and ball points of different sizes are provided to suit a wide range of screw threads.

Measuring equipment made by the Pratt & Whitney Co., Inc., is handled in this country by Buck & Hickman, Ltd., Otterspool Way, By-Pass, Watford, Herts.

High-speed Template Hole Locating and Drilling Machine

The machine here shown has been developed by the Hicks Co-ordinator Division of the Wiedemann Machine Co., Philadelphia, Pa., U.S.A., for rapidly locating and drilling holes in flat sheet metal workpieces, such as templates, drill jigs, and simple fixtures. It is particularly suitable for the production of templates up to 36 by 42 in. for Wiedemann turret punch presses, and other equipment, and holes from $\frac{1}{16}$ to ⅜ in. diameter can be located and drilled to an accuracy of ± 0·002 in.

In operation, the workpiece is located against an end-stop and is secured to a cross-slide by



Wiedemann high-speed template hole-locating and drilling machine

means of positioning-type clamps. With the aid of an *X* and *Y* co-ordinate chart, the operator sets the required dimensions by means of two optical scanners which are used in conjunction with fixed scales. The hole is then drilled from the underside of the material, the drill being steadied close to the work by a carbide guide bush. Since the position of the holes is determined by *X* and *Y* ordinates from a common datum, there is no accumulative error.

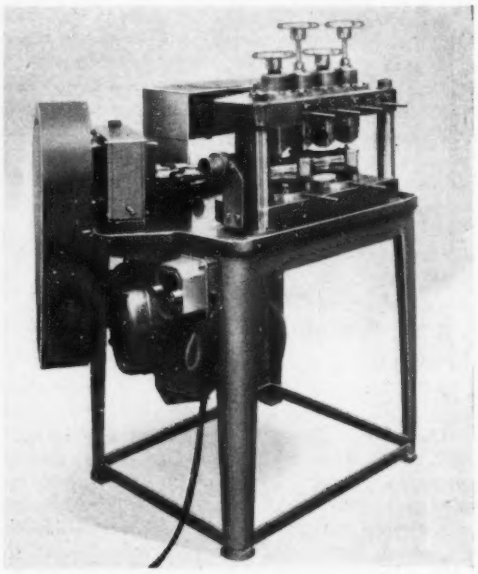
Dowding & Doll, Ltd., 346 Kensington High Street, London, W.14, are the agents in this country for the Wiedemann Machine Co.

Special Bronx Multi-roll Tube Straightening Machine

The machine here shown has been designed and built by The Bronx Engineering Co., Ltd., Lye, near Stourbridge, for straightening operations on tubular rocker shafts for motor car engines. These shafts, which are of high-carbon steel, range in diameter from 0·668 to 0·8736 in., and have a minimum length of 14½ in. Each shaft is subjected to two straightening operations, one after a normalizing process, and the other after machining and prior to final centreless grinding. When the shafts are brought to the machine for the second straightening, they are out of truth by amounts varying from 0·025 to 0·036 in., and one pass only is required, at the rate of 100 ft. per min., to reduce these figures to 0·0015 and 0·0035 in., for components 14½ and 20 in. long, respectively.

As can be seen from the figure, there are two banks of straightening rolls. The lower bank has two rolls, which are driven by a 6-h.p. constant-speed motor through a gear box and universal couplings, and the upper bank has four free-running rolls. Provision is made for adjusting both sets of rolls angularly, and the upper bank can be adjusted vertically to accommodate different sizes of tube. All the rolls are of heat-treated alloy steel, and are mounted on needle bearings.

The driving motor is controlled by a push-button operated stater mounted on the welded steel base member, and a tank is incorporated which provides a drip-feed of paraffin to clean the surfaces of the rolls, and ensure that the shafts are effectively gripped as they are passed through the machine.



Bronx multi-roll tube straightening machine

Selector Arrangement for Drilling Holes in Oil Cooler Plates

By J. BURNHAM*

An unusual machine is employed to drill many thousands of holes in particular patterns in the shops of the AiResearch Mfg. Co., U.S.A. The drill head is equipped with 30 spindles in line which extend across the width of the machine table. Selection of the particular drills to be utilized at each phase of the cycle is determined by a perforated steel "template" wrapped round the large drum-type spindle selector, seen in the heading illustration.

* AiResearch Mfg., Co. Division of the Garrett Corporation, U.S.A.

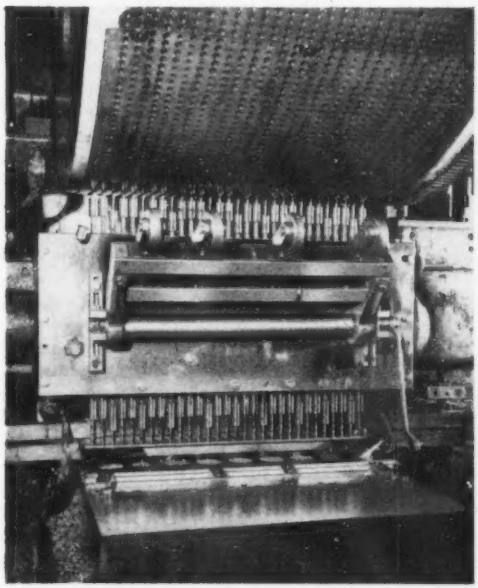


Fig. 1. The thirty drill spindles which are arranged in line beneath the drum-type selector of the machine shown in the heading illustration



The machine was developed some years ago as the result of a contract to manufacture oil coolers for the B-29 aircraft. Production of the aluminium oil coolers—which were introduced to replace copper and brass units—necessitated drilling large numbers of holes in the header and support plates. Company engineers supplied the Moline Tool Co. with a set of specifications for a multiple-spindle machine which would perform the plate-drilling operations economically. As a result of these co-ordinated efforts, the rotating-drum drilling machine was built.

Until the new machine was placed in service, 15 single-spindle drill presses were required, and many jigs were needed for the various hole patterns. These patterns were drilled in elliptical oil-cooler plates with peripheral lengths from 150 to 400 in. and through circular plates from 10 to 22 in. diameter.

Hole patterns in 20 different plates are now being drilled on the rotary-drum machine. The holes necessary to form a particular pattern are produced by a series of feed strokes, and at each stroke a straight row of holes is drilled across the surface of the work. Because only certain drills are to be used for any given row of holes, a means of choosing the individual spindles must be provided. It is the purpose of the perforated steel "template" to control their selection, and it has a

combination of through holes and dimples, as seen in Fig. 1.

For the feed movement on this machine, the work-table is elevated towards the spindle-selector drum by cam action. The drill head, which is mounted on the same slide as the work-table, is elevated simultaneously.

When the drill spindles reach the selector drum, extensions on those spindles aligned with template holes pass through them, but the movement of those spindles which are aligned with dimples is arrested. Consequently, continued elevation of the work-table forces the workpieces into contact with only those drills that are being held down by contact with the steel template.

In Fig. 2 the front cover plate has been removed to expose the spindle-drive mechanism. Also, for purposes of illustration, the drills have been fed behind the workpieces. Since all the spindles rotate continuously, the drilling operation begins immediately.

The portion of each spindle that contacts the template is fitted with roller bearings, and remains stationary while the spindle rotates. Drive is transmitted to the spindles by a long horizontal spiral gear at the rear, which meshes with a mating spiral gear on each spindle.

In the bore of each spiral gear there is an integral key which engages with a long keyway in the spindle shaft, as seen in Fig. 3. The rotating spindle can thus move through the spiral gear.

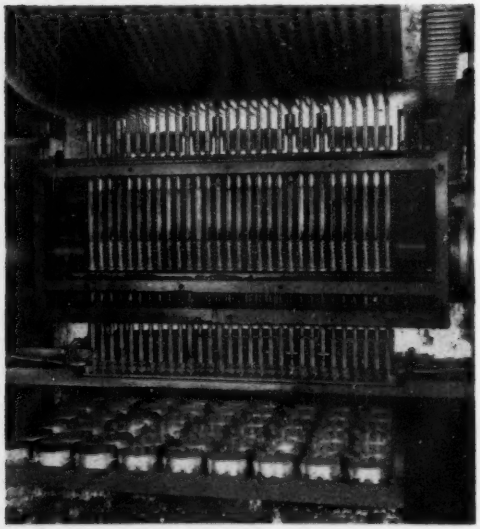


Fig. 2. The work-table and drill head are mounted on the same slide. As they approach the selector drum, those spindles aligned with dimples in the template are arrested

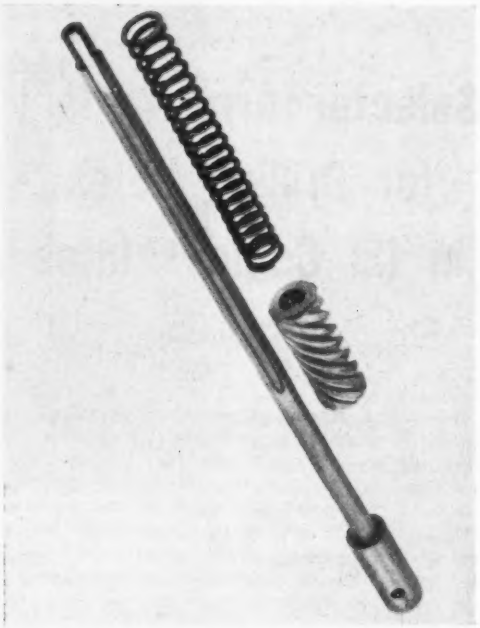


Fig. 3. The principal components of the spindle assembly. Drive is transmitted through a spiral gear with an integral key

A spring, mounted on the upper portion of each spindle, is compressed when the spindle is arrested by contact with the drum template, and the head continues to move upwards.

The centre distance required between the holes is 0·250 in. and the drills are spaced 0·750 in. apart. Two lateral indexing movements of the work-table are therefore necessary to complete the drilling of each row of holes. A cam arrangement beneath the table controls these lateral movements.

After each feed stroke has been completed, the selector drum is indexed to bring a fresh row of holes into line with the drill spindles. Lateral movement of the work-table is synchronized with the indexing of the drum. When the drills have made the three feed strokes necessary to complete one row of holes, a rack-and-pinion mechanism advances the table and workpieces in readiness for the 3-stage drilling of the next row.

Oil-cooler equipment for each B-29 aircraft requires 5,400 holes, of 0·217 in. diameter. Additional savings in time are obtained by stacking the parts on the machine table.

Die Casting Supplement

Die Casting Electrical Components

The Practice of Metropolitan-Vickers Electrical Co., Ltd., Manchester

The die casting foundry operated by the Metropolitan-Vickers Electrical Co., Ltd., at their Trafford Park, Manchester, factory, produces castings in zinc, aluminium, brass, and aluminium-bronze. Pressure die casting machines are employed for the first three, and aluminium, brass, and aluminium bronze are also cast by the gravity process. In addition, castings in certain alloys, including brass, are made by means of a simple low-pressure process, whereby the molten metal is forced upwards into the die cavity by an air cylinder. Many of the dies originally designed for this low-pressure process, however, are now being converted for use on conventional pressure casting machines, to avoid duplication of processes.

Almost all the castings made in the 500 dies in current use, are for electrical applications and comprise such components as brush-holders for electrical machines, brackets, and frames. Cubicle or cabinet door handles are also made in small numbers. Since pressure die casting of brass, or other copper-base alloys, is not commonly undertaken, some typical brass castings made by both the high- and low-pressure methods, and the dies in which they are produced, will be described in this first article, and components cast in the more usual alloys will be considered later. First, however, the layout of the foundry, the plant installed therein, and the adjacent fettling shop will be briefly discussed.

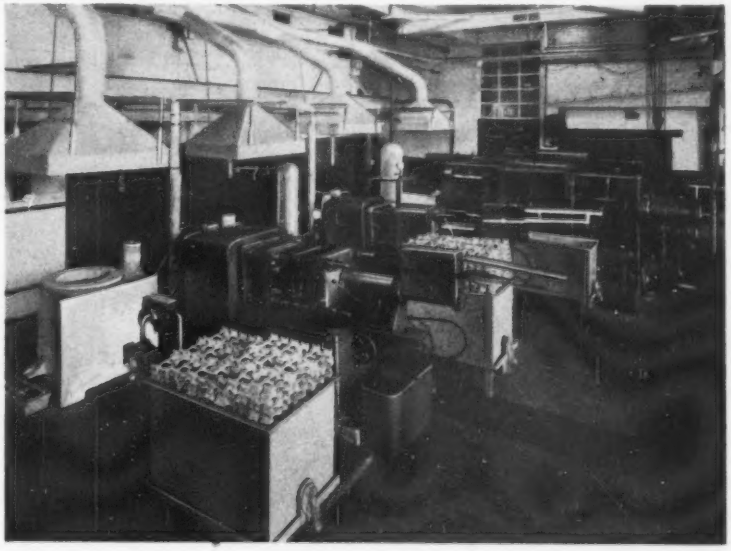


Fig. 1. This view of a section of the Metropolitan-Vickers' foundry devoted to the die casting of aluminium alloys and brass shows the two No. 12 and the two No. 20 E.M.B. machines

FOUNDRY LAYOUT

The die casting foundry occupies a rectangular portion of one of the large buildings on the extensive site at Trafford Park, and a view showing an area devoted to pressure die casting is given in Fig. 1. In this section are installed two No. 12

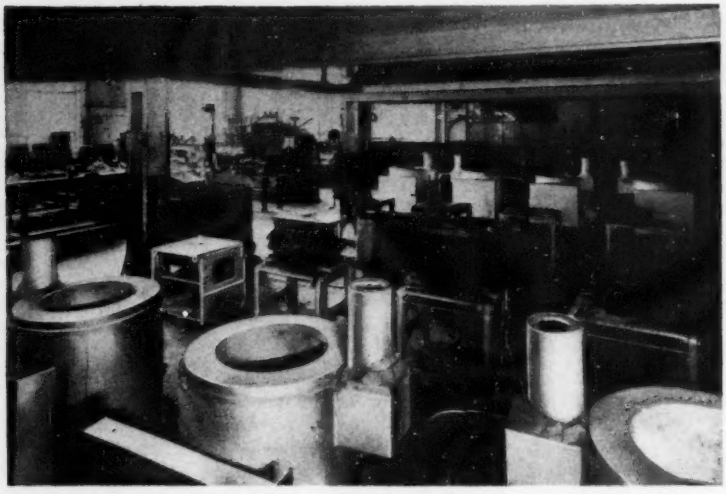


Fig. 2. Gravity and low-pressure die casting of brass, aluminium-bronze and aluminium alloys is carried out in this area, which adjoins that shown in Fig. 1

and two No. 20 E.M.B. cold-chamber machines, which are employed for brass and aluminium alloys only. A hot-chamber conversion unit is available for one of the larger machines but is used infrequently since there are only three large dies for zinc castings, and these are seldom in use. Bale-out furnaces of the company's own construction, comprising steel shells lined with fire-brick, are conveniently located alongside the machines and are gas-fired.

Fig. 2 is a view looking in the opposite direction, and shows, in the foreground, the area devoted to gravity casting of aluminium and aluminium-bronze. Here, substantial steel and cast iron benches, fastened to the floor, are provided to hold the gravity dies, and there is a bale-out furnace near each bench. The low-pressure process, mentioned above, is carried out at the far side of the shop, in this view, on specially-adapted benches. Beyond, and to the left, is an area devoted exclusively to the casting of zinc-base alloys, which is partitioned from the remainder of the shop. Here, the largest machine installed is a No. 12 E.M.B., which is capable of producing all except the very largest zinc castings, referred to earlier. Smaller castings are still produced on special machines of Metro-Vick design to which later reference will be made.

The remainder of the shop, to the right and left of the areas shown in Figs. 1 and 2, provides for inspection of castings, temporary storage of dies which are about to be put into service or are ready for return to the basement storage area, and for box pallets, either full of castings for transport to the fettling shop, or empty, ready for re-use. Display cabinets with sample castings are maintained, and a heavy-duty weighing machine assists in checking quantities of castings and ingot material. From the photographs it will be noted that large sheet metal shrouds are provided, which cover both the dies and the bale-out furnaces in the gravity casting area, and shrouds are also fitted above the bale-out furnaces adjacent to the pressure die casting machines.

All these shrouds are connected by ducting to fans at one side of the building so that fumes are efficiently extracted. Further fans on the other side of the shop bring in fresh air to replace that extracted with the fumes. Beyond the wall seen at the left-hand side in Fig. 1 there is a small shop for the centralized melting of all the metal, except zinc.

Here, several rotary-type furnaces of Metro-Vick construction are installed for melting brass and aluminium alloys, also a number of floor-set crucible units for aluminium-bronze. Metal, which is melted in this department is transferred by means of a trolley to the appropriate bale-out furnace in the casting shop. A trolley-borne hot-junction type instrument is employed to check the die temperatures when production starts and at other times, if necessary, and is also used to check the temperature of metal in the bale-out furnaces, when required.

FETTLING SHOP

As previously indicated, the fettling shop is adjacent to the die casting foundry, and is located beyond the end wall in Fig. 1, being reached through a large double door. A general view in this shop is given in Fig. 3, and among the modern equipment installed may be noted air-operated vices, controlled by pedal valves, which enable the operators to open or close the jaws while holding



Fig. 3. Adjacent to the foundry is the fettling shop in which air-operated hand tools and vices, and Hydraclamp universally - adjustable holding units, are employed

the work with both hands. Another useful aid in positioning castings for fettling operations is the Hydraclamp, made by Spencer, Franklin & Co., Ltd., which takes the form of a ball and socket head with universal movements. The head can be clamped hydraulically in any desired position by turning a screw, and is fitted with a special holder to suit the particular casting, which is secured by cam or toggle-type clamps.

Other special clamps for specific castings are fastened to the edges of the benches. In addition to the normal files, power-operated tools fitted with rotary files and burrs of different shapes are provided, and special holders of sheet metal are fastened to the undersides of the bench tops at the sides of the vices. With this arrangement, it is unnecessary to put power tools down on the bench, where they may easily be knocked off or otherwise damaged, and bench tops are kept clear for other hand tools. As may be seen from Fig. 3, the benches are arranged back to back, and screens of wire mesh are placed between them, to protect operators from flying chips.

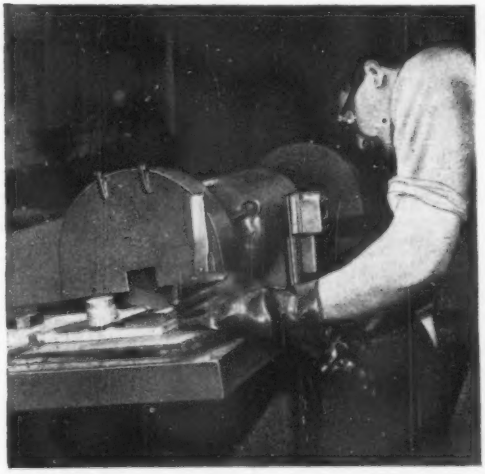


Fig. 4. For cutting the runners from frame type castings which are centrally gated, this modified double-ended polishing spindle, which is fitted with abrasive cut-off wheels, and a swinging table to hold the work, gives good results

Gates and runners are normally cut from gravity castings with the aid of a bandsaw, in the conventional manner, but certain castings, such as simple frames, are often gated internally for convenience. Consequently, if a bandsaw were employed it would be necessary to break and weld the saw for each casting. A special machine, a view of which is given in Fig. 4, has been provided for these castings, and it incorporates a standard double-ended polishing spindle, both ends of which have been modified and fitted with abrasive cutting wheels.

For safety, each wheel is fully shrouded with sheet metal guards, and beneath it is fitted a framework carrying a table which is hinged at the end remote from the operator. Each table is counterbalanced so that it normally rests on a stop at a lower level than the wheel, and it has a handle at the operator's side whereby it can be raised and lowered. Toggle-type clamps are fitted to each table top to enable the casting to be quickly secured, and it is normally supported on an open frame, screwed to the table, which provides clearance for the wheel to pass completely through the runner bar which is being cut off. As regards speed of operation, the machine is comparable with the normal bandsaw.

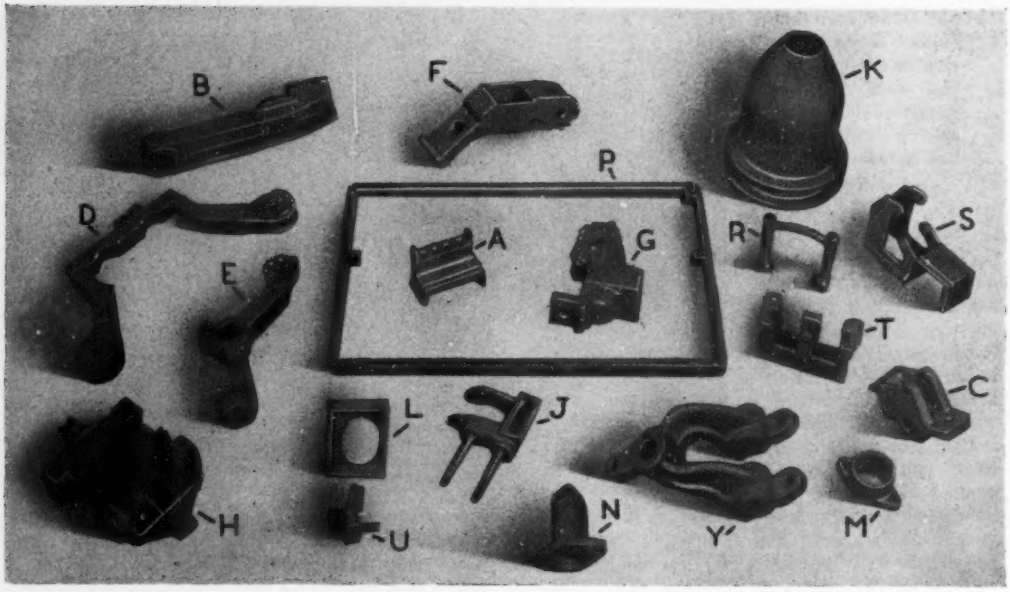


Fig. 5. Examples of brass die castings made by the conventional cold-chamber and the low-pressure die casting processes. The terminal block casting at *A* is required at the rate of 8,000 per week

CASTING ALLOYS AND DIE MATERIALS

Although four distinct metals or alloys are cast in the foundry, only one composition under each heading is normally employed, and the zinc alloy conforms to B.S. 1004 for purity. The aluminium alloy is 3L 33; and the aluminium-bronze contains, approximately, copper 86, aluminium 10·5, and iron 3·5 per cent; and the brass, copper 63, zinc 36, silicon 0·45, and aluminium 0·5 per cent. Pouring and injection temperatures for these alloys range from the normal 420 to 450 deg. C. for zinc, to 680 deg. C. for pressure casting and 750 deg. C. for gravity casting aluminium, 980 deg. C. for brass, and 1,150 deg. C. when casting in aluminium-bronze.

It will be appreciated, in view of these temperatures, that the dies employed for brass- and aluminium-bronze alloys are subjected to extremely severe conditions in service. For such dies, bolsters of cast iron or mild steel are employed, with inserts of heat-resisting steel in which the cavities are cut. Among the steels most widely used by the company for brass may be mentioned Arthur Balfour's No. 227 special hot die quality, which contains tungsten, 9 to 10, and chromium 3 per cent; and Sanderson Brothers & Newbould's Sabex, with tungsten, 9 to 10, chromium, 2 to 2·5, and nickel 1·5 to 2 per cent. For aluminium-bronze, Balfour E.X.D.5 hot die steel, with chromium and tungsten, 11 to 13, and vanadium 0·9 to 1·2 per cent is also employed, as well as the No. 227 steel referred to earlier.

The life of die inserts made from these materials varies with the thickness of the casting section produced in each part of the die, and where heavy sections are involved the cavity surface is subject to checking, and the cracks penetrate and spread until a small portion breaks off. When such damage occurs, the insert is built up by welding with a suitable filler wire and machined down to size. For those dies which require frequent renewal, spare inserts may be held in stock, to enable repairs to be carried out rapidly. Before such dies are put into service, the inserts are hardened to about 44 Rockwell C, and although it is thought that this hardness may be reduced in service, no records have been kept.

The cast iron or mild steel bolster also suffers, although to a lesser degree, and normally has a life of about three sets of inserts. An average life for a set of inserts may be as much as 70,000 shots, as in the case of the dies shown in Fig. 6, to which further reference will be made later.

BRASS PRESSURE DIE CASTINGS

A total of about 40 different pressure die castings in brass has been made by the foundry, but fluctuations in demand have reduced the number in regular production to about 15. A selection of the more interesting of these castings, most of which are still in regular production, is shown in Fig. 5, and, of these, the terminal block *A* is required in much the greatest numbers, approximately 8,000 being made per week. For most of the other brass parts the output is relatively small, being of the order of 250 to 300 per batch in 1, 3, 6, or 12 months, which is just sufficient to render die casting economical.

Some brief particulars of the castings shown in Fig. 5 will now be given, and those that present unusual features will subsequently be considered in greater detail. At *B* is seen a hollow transformer lever, 7 in. long, incorporating an integral bush at one end, and at *C*, a transformer bracket. Several different types of carbon brush-holders are produced by both low- and high-pressure die casting, and examples of these holders, which incorporate means for tensioning the springs as the brush is worn down, are seen at *D*, *E*, *F*, and *G*. A clock-type spring, employed in such a holder, has a hook at the end opposite to that which makes contact with the carbon.

On the outside surface of the brush-holder is cast a series of angular projections round the edge of the partly-circular housing for the spring. The hook on the end of the spring can be engaged with any one of these projections, depending on the length of the remaining carbon in the brush. Other types of brush-holders are seen at *H* and *J*, and dies for these castings will be described later. Cable glands are often made as brass die castings, and examples are seen at *K*, *L*, *M*, and *N*, the last two being made in 2-impression dies. The gland at *M* is made by the low-pressure process, as will be described later. Stiffening for the opening of a die cast aluminium electronic cabinet unit is afforded by the cast frame *P*, which measures 12½ by 8 in., and has section dimensions of approximately ½ by ¼ in.

This frame casting is held to limits of + 0 − $\frac{1}{64}$ in. on the dimensions quoted. A simple handle casting is seen at *R*, and a switchgear bracket at *S*. The brush-holder liner *T*, receives the carbon brush, and fits into a larger casting. It has a rectangular slot for the brush, and to ensure parallel walls, this slot is finished, by broaching, to 2½ by ⅝ in., about 0·010 to 0·015 in. per side being removed. The casting at *U* is a terminal and is attached to a spiral resistance tape. Since the tape meets the terminal at an angle, a projection on one side is set at the same angle so that a neat joint can be obtained.

TERMINAL BLOCK DIE

By reason of the large numbers required, terminal blocks of the type seen at *A*, Fig. 5, are in almost continuous production, and two dies have therefore been provided, repair and maintenance work being carried out on one, while the other is in use. The casting is employed to hold in position the four ends of the Redring, tubular, coiled, radiant-heating element for electric cookers, and to provide means for connecting the conductors. The ends of the elements are inserted into the four holes cored in one face of the block, and brazed in place. For some designs of element, with single coils, only two holes are required, and the die is then modified, as necessary, to accommodate this difference.

A close-up view of the die in position on one of the No. 12 E.M.B. machines is given in Fig. 6, and it will be seen that the weight of the overhanging portion of the moving half die, at the right, is supported by a horizontal bar with a roller at each end. The rollers run on the upper tie bars, and help to preserve alignment of the two halves as the die is closed. As may be seen from the

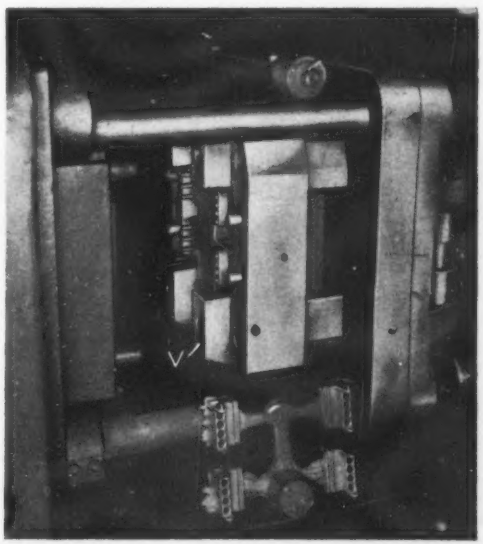


Fig. 6. Close-up view of the die for the terminal block casting *A*, Fig. 5, showing the disposition of the cavities and of the four cores *V* which form a peg on one ear of each casting

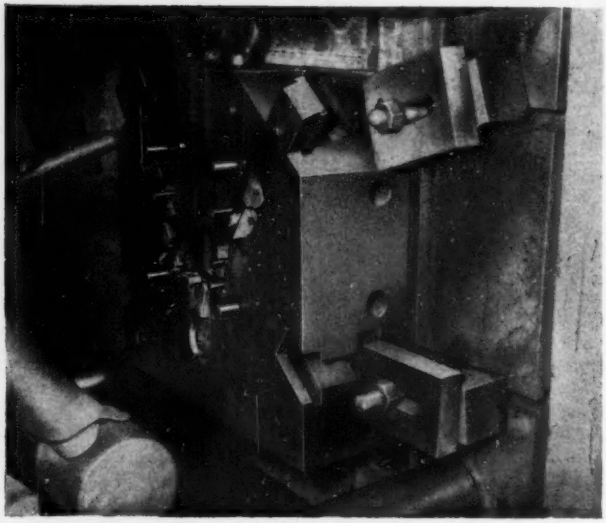


Fig. 7. A view of the moving half die for the double brush-holder casting *D*, Fig. 5, showing the four cores which form the rectangular brush apertures and the internal surfaces of the tensioning spring housings

spray of castings in the foreground, the die has four impressions, and the holes to receive the element ends are formed by fixed pins in the moving half. These pins project from the face of an insert which cores-out the interior of the block casting, and this insert can be changed to produce castings with either two or four holes.

Ears are cast at the ends of the block, and on the outer face of each ear there is a cylindrical peg of about $\frac{3}{16}$ in. diameter by $\frac{1}{4}$ in. long, to serve as a hinge pin for mounting the block in the final assembly. To enable these pegs to be cast integral with the block, the die was originally designed with only two cavities, one on each side of the central sprue, and two moving cores on each side, which formed the outer surfaces of the ears and had holes to produce the pegs. When it became necessary to increase production by means of a 4-cavity die, the casting was redesigned, so that only one of these pegs needed to be cast integral.

The other peg was inserted in a drilled hole in the casting during assembly, this procedure being found more convenient for assembly purposes also, and the 4-cavity die was then produced. In this die, a peg is formed on one ear of each casting by means of a hole in the end face of a vertically-moving, cam pin-operated core in the moving half die, one of these cores being indicated at *V* in Fig. 6. A recess in the end face of the cores also forms the outer surface and sides of one ear. For the spray of castings shown, the shot weight is approximately 3 lb. 13 oz., and each casting weighs 4 oz. in the trimmed condition. This disparity between spray and casting weights is normal with brass, since the runner bars must be of substantial proportions if premature freezing of the metal is to be avoided.

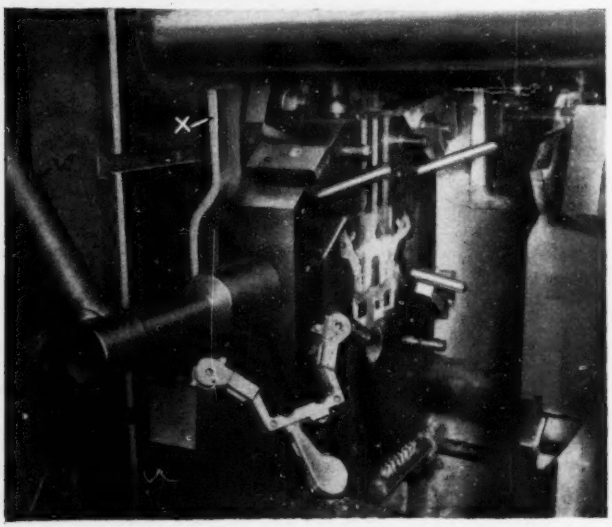


Fig. 8. A view of the fixed half of the die in Fig. 7, showing the levers for operating and locking the cores whereby the angular teeth on the outer face at each end of the casting are formed

BRUSH-HOLDER DIE

Another die, employed on one of the No. 20 machines, is shown in Fig. 7, where details of the moving half can be seen, and Fig. 8, which

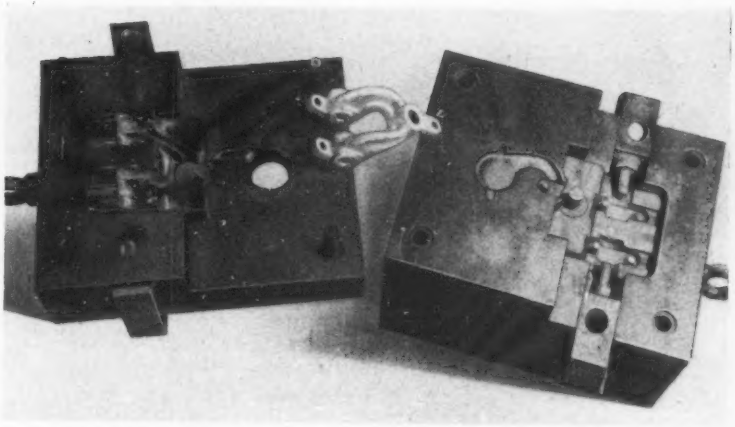


Fig. 9. The two halves of the die for the transformer bracket casting shown at the centre. Core pins made from austenitic steel have proved satisfactory for die casting dies for brass

gives a view of the fixed half, and a casting with runners still attached. This casting is the double brush-holder seen at *D* in Fig. 5, and the component measures 7½ in. between the holes in the partly-circular faces at the ends. Between the central mounting bar and these faces, the casting has two apertures of rectangular shape to accommodate the brushes, and these apertures are formed by conventional sliding cores on the face of the moving die. Housings for the brush-tensioning springs, between the partly-circular faces at each end of the casting, are formed by means of two more cores, above the cavity.

As mentioned earlier, one outer face of each spring housing incorporates integral angular teeth whereby the brush spring is tensioned, and the form of these teeth can be more clearly seen in Fig. 13, which shows a similar brush-holder. It will be observed that the teeth have angular faces to ensure that the spring is securely held, one side of each tooth being undercut. The teeth, together with the adjacent face of the spring housing, are formed in the fixed die member seen in Fig. 8, and retractable cores are employed, which are moved in a direction substantially parallel with the machine axis. At the same time that the cores are retracted from the casting, they are turned slightly, so that they are, in effect, unscrewed from the angular projections.

Movement of the cores is effected through a rack and pinion arrangement in the fixed half die, operated by the lever *W* in Fig. 8, and the cores are turned by means of helical grooves in their sides, which are engaged by pins in the die.

During the time of the casting operation, the cores are locked in place by a sliding bar actuated by the lever *X*, and before the dies can be opened, at the end of the solidification period, the cores must be unlocked and retracted from the casting. Dies for brass, it may be noted, are dressed with Foundry Services Dycote 60, which is applied by means of a spray and mop.

TRANSFORMER BRACKET DIE

The die in Fig. 9 is employed for the production of the transformer bracket shown, and another view of this casting is seen at *Y* in Fig. 5. In the moving half of the die, at the right, there are cylindrical core pins to form holes in the projecting bosses at the ends of the legs. Two additional holes, the axes of which are parallel with those of the holes in the bosses, are formed by other core pins adjacent to the runner bar. Each leg of the casting incorporates a circular boss which is cored by a pin on a moving slide at the side of the die, operated in the conventional manner by means of an angular cam pin.

Core pins employed for brass die casting are subjected to particularly severe conditions, and experiments have been made with many different steels to find a material that will give satisfactory life. Good results have been obtained with hardened and ground cores of tungsten-chromium alloy steel, but at present the majority are made from Kayser, Ellison No. 965 valve steel, which is used in the austenitic condition and has a moderately long life. Unfortunately, this material is too hard to be easily machined into the intricate shapes required for some cores. The brass casting shown has a trimmed weight of 1 lb. 13 oz. and the shot weight is of the order of 4 lb.

BRASS CASTING WITH BRASS INSERTS

The brush-holder casting indicated at *J* in Fig. 5 is made in the 2-cavity die shown in Fig. 10. This casting is of interest mainly on account of the two threaded (No. 2 B.A.) studs which are incorporated as inserts, and are made from brass. Examples of these inserts are shown at the centre

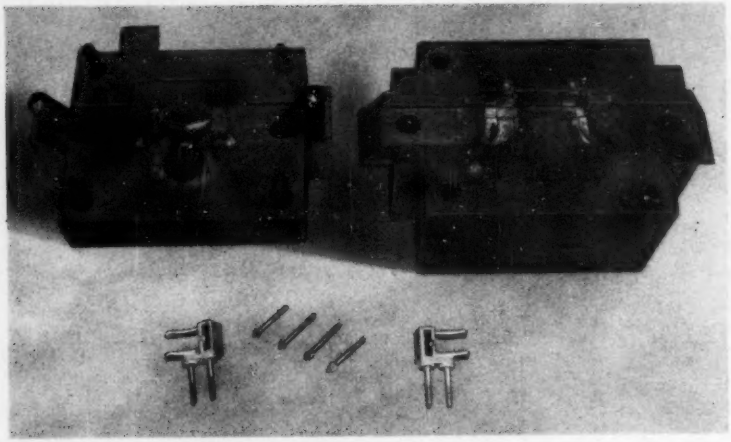


Fig. 10. Brush-holder castings made in this 2-cavity die have threaded brass stud inserts, machined from square-section bar material, cast in position

in Fig. 10, and they are produced from square-section bar material, part of which is left unmachined, near one end, to provide a secure anchorage in the casting. Holes for the reception of four of these inserts can be clearly seen in the fixed half of the die at the left in Fig. 10.

The inserts are of different head thicknesses, to suit the bosses in which they are incorporated. At each side of the die there is a core slide carrying two projections. One of these projections serves to produce the rectangular aperture which accommodates the carbon brush, and the other cores-out the space between the two curved legs of the casting.

LOW PRESSURE DIE CASTING

For low pressure die casting, dies are sometimes made from cast iron if the numbers of parts required are so small that the use of more heat-resistant materials would not be economic. Most of the dies, however, are of similar construction to those employed for the high pressure process, incorporating inserts of heat-resisting steel, and can be fairly easily converted for use on the E.M.B. machines, as mentioned earlier. A typical low pressure casting set-up is seen in Fig. 11, and the bench is of similar construction to those employed nearby for gravity casting. Beneath the bench is mounted an air cylinder of 4-in. bore diameter, supported on short studs with the ram projecting upwards. The thick steel top of the bench is bored near the centre and fitted with a bush of 2¾ in. bore diameter, which corresponds to the sleeve in a conventional die casting machine.

At the lower end, the bush is closed by a plunger connected to the air cylinder ram, and when the bush is filled with metal, and a die is placed in position above it, operation of a valve results in the application of air pressure beneath the piston in the cylinder. The ram is thus raised, and the metal is injected upwards into the die. Before the metal is poured into the bush, a disc and a strip of thin asbestos sheet, as seen at Z, are placed inside to provide a heat-resistant protecting lining. This material is crushed during the injection stroke, but it serves

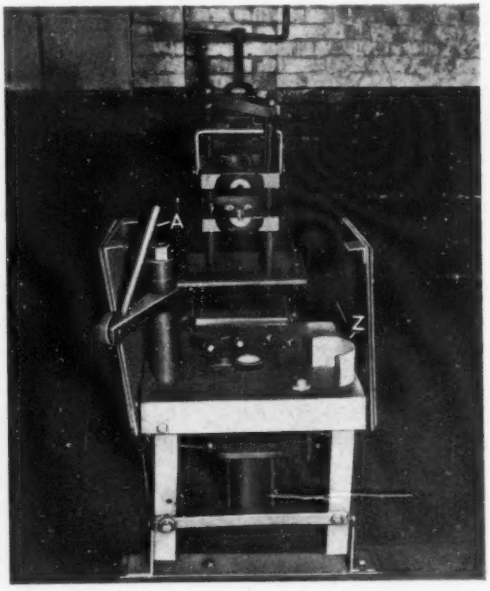


Fig. 11. General view of the equipment employed for low pressure die casting brass and aluminium alloys. When the closed die has been clamped in place, metal in the bush is injected upwards by the air cylinder beneath

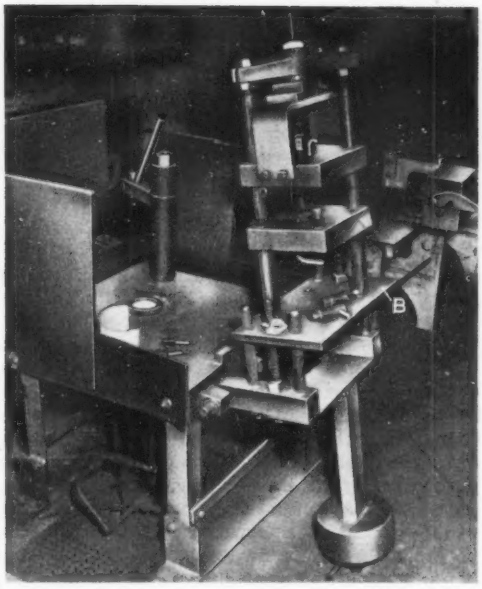


Fig. 12. Another view of the low-pressure die casting equipment showing the method of attaching the die to the table. The heavy die is counterbalanced by a large weight to facilitate movement to and from the casting position

to reduce the amount of heat transferred to the bush before the metal is injected into the die. The die is clamped by means of a cam at the end of the lever *A*, which is pivoted on a horizontal arm, the latter being free to turn on a vertical post at one side of the table.

Another view of the set-up, in Fig. 12, shows the method of attaching the die to the table. The die is carried on two posts which are anchored in a plate *B*, and this plate, in turn, is supported by screwed studs on two brackets hinged to the side of the table, location being provided by cylindrical guide posts. A circular register projection, machined partly on the side face of each of the two die halves, as seen in Fig. 11, is required just to enter the bore of the bush when the die is lowered into the casting position, and the height of the plate *B* (Fig. 12), above the hinge point is adjusted, by means of the threaded studs, until this condition is obtained.

Short lengths of tube on two posts support the lower half die (as viewed in Fig. 11), and the posts extend upwards, through the upper half die, to a cross-piece above. This cross-piece has a threaded boss with a screw to which the upper half die is connected by means of a stirrup, and the die is closed and clamped by means of the screw. Guide pins are provided on the lower half die and enter corresponding holes in the upper half die in the conventional manner. When the die has been closed, and any loose cores inserted, it is ready for the casting operation. The bush is first lined with fresh asbestos material which is provided ready cut to size, and the metal is then poured in.

Lowering of the die into a position in which the register is engaged with the bore of the bush is facilitated by the provision of a large counterweight carried on the end of a bar attached to the under-side of the plate *B*, and the die is then clamped with the aid of the lever *A*, Fig. 11. The valve controlling the air cylinder beneath the table is now operated, and the metal in the bush is injected into the die cavity. The die seen in the set-up in Fig. 11 and 12, is for the small gland

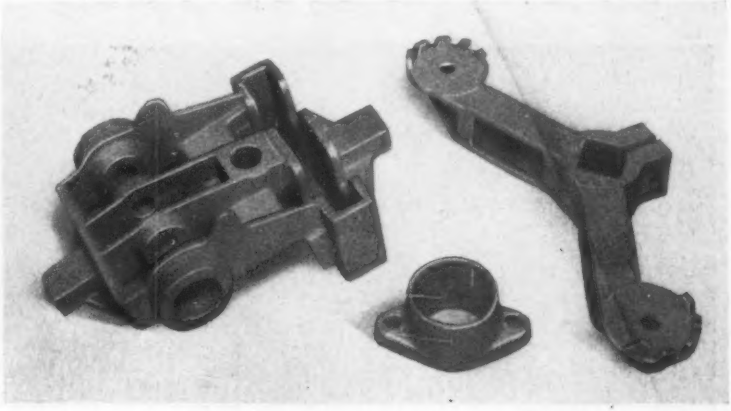


Fig. 13. Three examples of brass castings made by the low pressure process. The angular teeth on the outer faces of the spring housings at the ends of the brush-holder at the right in the figure can be clearly seen

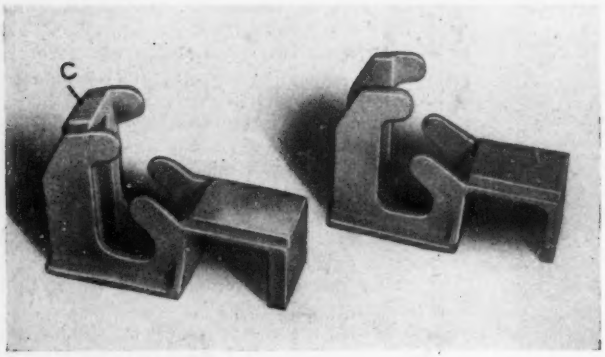


Fig. 14. When the sand cast component (left) was made by pressure die casting it was possible to dispense with the strengthening bar *C*, and to reduce the section thickness and, consequently, the amount of material required

casting at *M* in Fig. 5, and has two cavities. Further details of this casting may be observed in Fig. 13, where it is seen near the centre, and the three cored holes are produced by the loose cores seen lying on the plate *B* and on the table in Fig. 12.

Four of these cores, which produce the smaller holes in each pair of castings, are inserted into the upper half of the die, and each has a cross-bar whereby it is retained, against the pressure of the injected metal, by a threaded stud, the upper end of which is bent at 90 deg. After inserting the core the stud is turned slightly so that the bent end projects above the cross-bar. The other two cores, which produce the large central holes in the castings, are inserted in the lower half die, and are retained in similar manner. In addition to retaining the cores in position, the cross-bars also enable the cores to be extracted, with the aid of a lever, after the casting has solidified.

Both the other castings shown in Fig. 13 are made in low pressure dies of this type. The distance between the hole centres at the ends of the arms of the double brush-holder casting on the right is approximately 5½ in. Another brush-holder for an electrical machine is seen at the left.

Among the advantages which the die casting process offers over sand casting may be mentioned greater accuracy and more economical use of materials. Certain of the components which are now die cast were formerly made as sand castings and provide interesting comparisons as regards the accuracy, surface finish, and thinness and evenness of section obtainable by the two methods. Brackets made by sand and die casting methods are shown in Fig. 14, and the improved finish and reduction of section thickness possible with the latter method are evident. With the sand cast component it was necessary to cast the strengthening bar *C* in position, to hold the two arms in place during cooling. This bar was subsequently removed by machining. For the die cast component, no such strengthening was necessary.

The large cable gland casting seen at the right in Fig. 15 has an outside diameter of 4¼ in. over the flanges, a bore diameter of 3¼ in., and a height of 6 in. Sectioned sand cast and die cast glands are seen at the left and centre respectively, and the evenness of section obtained with the die casting process is clearly indicated, also the substantial material saving.

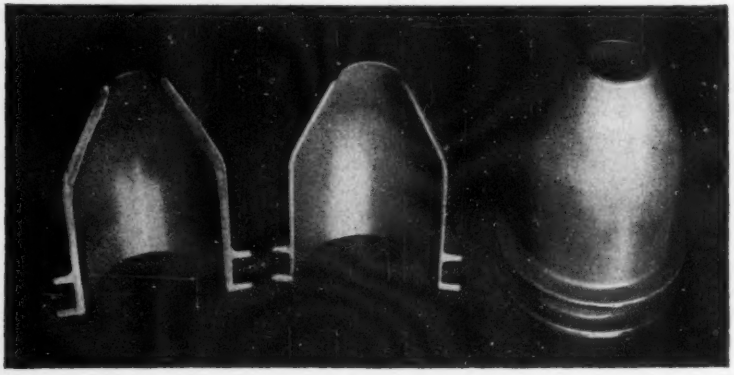


Fig. 15. This large cable gland was formerly made by sand casting. A considerable improvement in surface finish and general appearance, and a reduction in section thickness were obtained when the low pressure die casting process was adopted

Producing Type Sectors for Calculating Machines

Business machines manufactured by the Victor Adding Machine Co., Chicago, Ill., U.S.A., have a printing-press action whereby the paper is moved to contact the type, instead of the type being pressed against the paper. With this arrangement, the number of components is reduced, and cylindrical type-sectors having rack-actuated gear segments are used instead of vertical-acting type-bars.

Each type-sector consists of a blank (on the periphery of which the required characters are formed by rolling), a gear-sector pressing, a hub, and two rack-retaining discs. The blanks are made on a power press from a special, electric furnace grade of non-crystallizing, cold-rolled steel. The material is supplied in coils, and contains about 0·06 per cent of carbon and 0·20 per cent of manganese and is heat-treated to a maximum hardness of 55 Rockwell B.

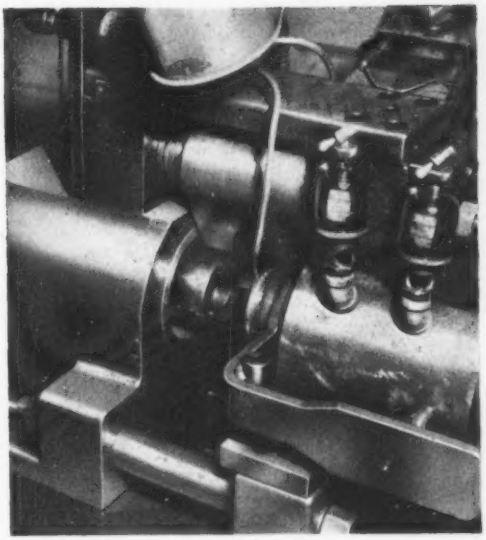


Fig. 2. Special hydraulic machine for rolling characters on the peripheries of swaged cups. A master roll is mounted on a spindle at the rear of the workpiece

The dimensions of a blank for one size of type-sector are given at the left in Fig. 1. These workpieces are made from 2⅝-in. wide by 0·0375-in. thick material on a 40-ton press which is run at 120 strokes per min. At this press set-up, three holes are pierced simultaneously in each blank to receive pins which transmit the drive during the subsequent character-rolling operation. Blanks are drawn and pinch-trimmed to a cup shape, as seen at the centre in Fig. 1, on a 22-ton press, which is run at 45 strokes per min. It is essential that the periphery of the cup should be free from score marks after drawing. Electrolytic cleaning follows and the cups are then swaged, on a 95-ton press, to the

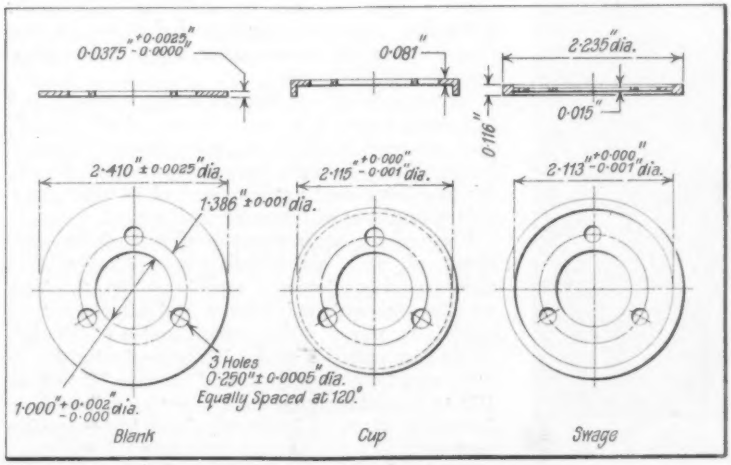


Fig. 1. Dimensions of blanked, cupped, and swaged blanks for the type sectors of business machines. The three small holes are provided for driving purposes

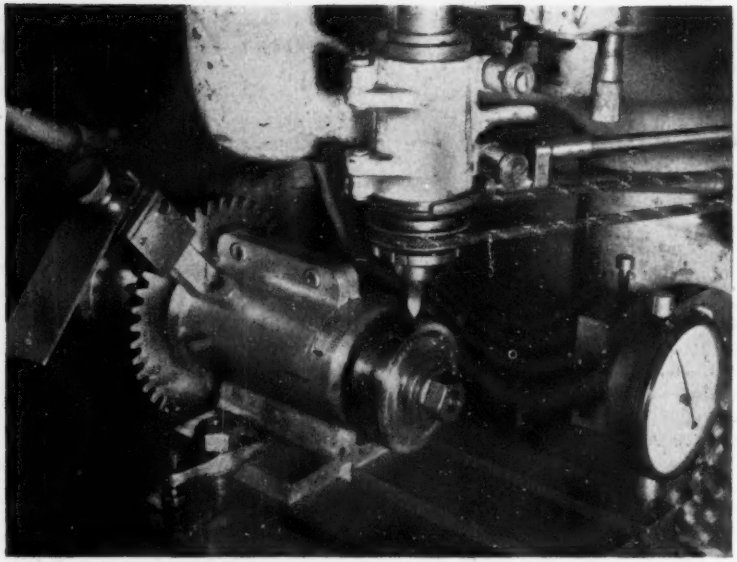


Fig. 3. Forty characters are engraved on the master roll using a two-dimensional pantograph machine equipped with a roll attachment and flat template

dimensions shown in the view at the right in Fig. 1.

Rolling of the characters on the peripheries of the swaged cups is carried out on a special, hydraulically-operated machine, Fig. 2, designed by Victor engineers. Four consecutive sets of characters are embossed around each part, which is subsequently slit to provide four sectors. The cup to be embossed is loaded on the work arbor of the rolling machine, and is hydraulically clamped. The other end of the arbor is connected to an electric driving motor. In line with the work arbor is a clamping plunger, which is urged towards the workpiece by a hydraulic cylinder. Drive is transmitted to the work by three spring-loaded driving pins which enter the holes previously pierced in the cup. Mounted on a shaft behind the work-arbor is a master matrix roll, in the periphery of which the required characters have been sunk. The roll is fed toward the work by a hydraulic cylinder seen at the upper right in Fig. 2, and the roll is rotated by a gear (mounted on the matrix-roll supporting shaft) that meshes with a gear on the motor-driven work-arbor. Extra-deep gear teeth are provided to permit continued infeed of the roll after it has made initial contact with the work.



Fig. 4. A slitting saw held on an arbor in a lathe collet is employed to separate embossed cups into four equal sections. The work-holding fixture is manually indexed

Matrix rolls are made from tough, close-grained tool steel, heated to a temperature of 1,675 deg. F. and quenched in oil, to give a hardness of 62 to 63 Rockwell C. The rolls are tempered at 325 deg. F. for two hours and again quenched in oil, to provide a hardness of 60 to 61 Rockwell C.

Forty characters are engraved around the periphery of each matrix roll on a Gorton two-dimensional pantograph machine, Fig. 3. This machine is equipped with a roll attachment to permit the use of a flat master, and a cone-point, single-flute cutter is used. Victor engineers design their own type characters, and prepare 50 to 1 or 100 to 1 photographic enlargements on linen-base Masonite, glass, or brass templates for engraving purposes.

While characters are being rolled on one part, the operator removes the drive holes from the previously embossed cup by piercing the centre

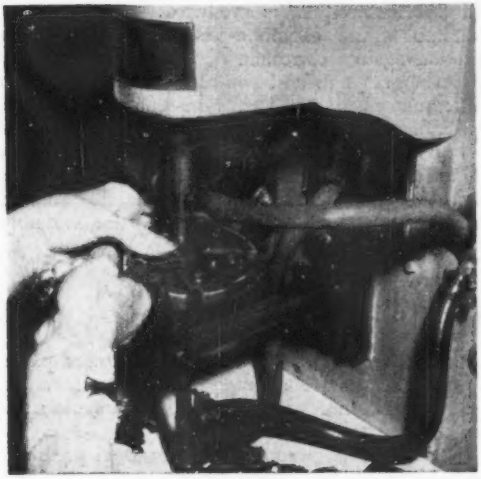


Fig. 5. The type-segment is joined to the gear-sector by means of three spot-welds. A segment is located from raised characters by means of seven spring-loaded plungers



Fig. 6. An Ipsen controlled-atmosphere furnace, here shown, is employed to case-harden welded assemblies to a minimum depth of 0·003 in. and a hardness of 55 Rockwell C

opening to a diameter of 1·700 in. This operation is performed on a 20-ton press. Flash formed on the edges of the cups during rolling is removed by facing on a Hardinge lathe, with the part mounted on an arbor which is held in the lathe collet. Two single-point tools on the hand-lever actuated cross-slide are applied to face both sides of the cup to a width of 0·110 in.

After the trimming stage, each cup is divided into four equal segments by slitting on another Hardinge lathe, Fig. 4. A slitting saw is mounted on an arbor held in the lathe collet, and the work-piece is located in a square block fixture by a central-spigot. The block fixture is slotted on each side to permit the entry of the slitting saw, and is indexed by hand. The fixture is guided by two bearing strips on the lathe cross-slide, and advanced manually to present the work to the saw.

Gear-sectors are produced from coils of 0·035 in. thick electrolytic-copper coated, cold-rolled steel, on a power press. The copper coating permits selective hardening of only the edges of the gear teeth. Without the coating, all surfaces of the sectors would be hardened and distortion would result. An embossed type-segment is secured to each gear-sector by three spot welds which are made on a Weldex 12 kVA machine, Fig. 5.

An intricate welding fixture is used for this operation, and has seven radially-acting, spring-loaded plungers, which locate the segment from the raised characters on its periphery. A spring-loaded slide with a gear-tooth projection at one end is used to locate the gear-sector from the central tooth space. A type-segment is loaded first, and a gear-sector is placed on top of it. The

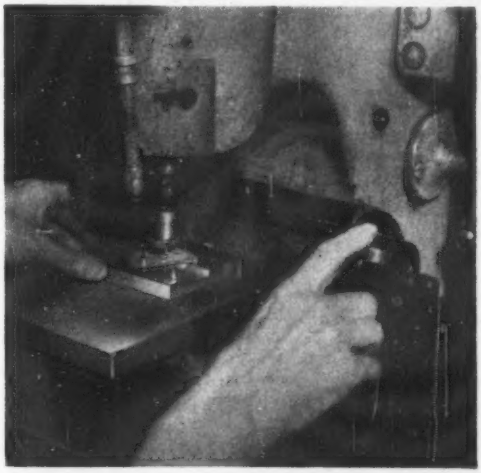


Fig. 7. One end of the bearing hub is rolled over the face of one of two rack-retaining discs on this rotary spinning machine

locating plungers also serve to thrust the type-segment against the gear-sector to ensure that the assembly is correctly seated before it is clamped by a hand-operated locking mechanism.

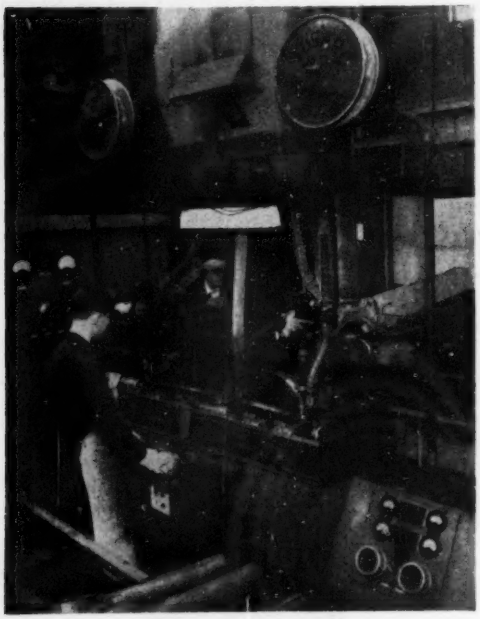
Welded assemblies are loaded on rods and suspended from fixtures for heat-treating in an Ipsen controlled-atmosphere furnace, Fig. 6. The parts are heated at a temperature of 1,475 deg. F. for 20 min. and are then quenched in oil. A 0·003- to 0·005-in. deep case, with a minimum hardness of 55 Rockwell C, is produced. The hardened assemblies are cadmium-plated to provide protection against corrosion.

A bearing hub and two rack-retaining discs are then assembled to each type-sector. A disc is positioned on each side of the sector, and one end of the hub is rolled over one of the discs on a Grant spinning machine, Fig. 7. Finally, the hub bore is reamed and deburred, and after final inspection, the type-sectors are ready for assembly.

Quasi-Arc Axle Case Welding Machine

The automatic axle case welding installation shown in the accompanying illustration has been developed by Quasi-Arc, Ltd., Bilston, Staffs, for Fisher & Ludlow, Ltd., Birmingham, and has permitted considerable reductions in the time required to weld these items. In some instances, the average welding time has been reduced to one eighth of that required for the former method, which was entirely manual.

The equipment incorporates two Unionmelt D.S. automatic welding heads, arranged to traverse horizontally along a runway above, and to the rear of, the work fixture, each being driven by its own traverse screw and motor. Welding current is taken from two 750-amp. D.C. power packs, which incorporate auxiliary D.C. generators for supplying current to the traverse screw motors and various controls.



Quasi-Arc Automatic Welding Machine for Joining Pressed Steel Axle Cases

Each axle case consists of two steel pressings, which are loaded into a jig where they are held and aligned by air-operated, self-locking clamps. This clamping mechanism also brings together two curved steel strips to form a trough into which the Unionmelt powder is gravity-fed from a hopper above the machine. There are two of these troughs, one on either side of the centre shaft hole of the axle case, and each is fed from a separate hopper. These troughs are particularly necessary for the smaller sizes of axle cases, where the curved surface on each side of the joint would not retain the necessary quantity of powder.

Welding starts at either side of the centre shaft hole, and the heads are traversed outwards to complete the two seams simultaneously. To ensure that welding starts at the extreme inner edge of the seam, a high-frequency current is employed to initiate the arc. This current is controlled by a master switch, and is automatically cut-off when the arc has been struck. At the end of the welding operation, the current is automatically switched off, and the gates in the hoppers are closed to stop the flow of powder. The fixture clamps are now released, and the axle case is removed by the operator and reversed, for welding the other side. During this sequence, the welding heads are automatically returned to the starting position. When the clamps are released, the powder troughs are opened, and any excess composition falls into a hopper below the jig, whence it is collected for subsequent re-use.

News of the Industry

Manchester and District

SLACKNESS AT THE IRON FOUNDRIES. In all sections of the Lancashire iron and steel market the cautious buying policy continues. With supplies of common irons and haematite readily obtainable, the majority of foundries are content to cover their immediate requirements. In the foundry trade, business has shown little change during recent months, and there is room for considerable improvement, especially in the light castings section. Demand for castings for the machine tool trade is reported to be patchy, and only a moderate aggregate tonnage of castings is being absorbed by the textile machinery industry.

LIMITED BUYING OF STEEL MATERIALS. Although the majority of steel users in this area have run down their stocks considerably, there is still no indication of any increase in buying activity. Even firms in the heavy electrical engineering trade, whose order books are heavier than the general average, are reported to be limiting the scale of business in plates and other materials. Structural steels are being requested in relatively moderate tonnages, and current buying of most other steel products is mainly based on the early rolling programmes at the mills.

BARBER & COLMAN, LTD., Marsland Road, Brooklands, inform us that the call for their various sizes and types of gear hobbing machines, and cutter and hob sharpening machines, from customers both at home and on the Continent, is maintained at a steady level. Ground and unground hobs for cutting gears, chain-wheel sprockets, ratchet wheels, serrations and splines are in good request, and there has been some expansion in the demand for Shakeproof locking washers and thread-cutting screws.

Our attention was drawn to the firm's No. 6-10 hobbing machine which has been completely re-designed. In its standard form, for commercial use, the machine can be supplied with bed lengths to give maximum hob slide travels of 10¾, 16½ and 20½ in. It will hob spur and helical gears, splines, serrations and special forms of 16 D.P. and finer, depending on the blank diameter. With the addition of extra tooling, it will cut worms and worm gears. A No. 6-10 precision hobbing machine is also built to provide the additional accuracy demanded for fine-pitch gears required for instruments and other precision mechanisms. We hope to describe this machine more fully in due course.

A recent addition to the range of hobbing machines produced is the No. 2¾-4 type, which has been specifically designed for precision instrument gears for missiles, radar equipment, and aircraft guidance and control systems. The machine has an indexing accuracy within 20 sec. of arc, and is designed to cut spur gears and pinions only. The maximum work diameter is 2¾ in., and the maximum length cut 4 in. Gears as coarse as 30 D.P. can be cut in steel, and 20 D.P. in brass. Hobs of from ½ in. diameter by ½ in. long up to 3 in. diameter by 2 in. long can be employed. We hope to make further reference to this machine at a later date.

NORTHERN AUTOMATIC SCREW CO., LTD., Golf Road, Hale, Altrincham, are busy with the production of standard and special screws, and repetition turned and threaded components. Demand for these products is well spread over the motor car, aircraft and general engineering industries, and it may be noted that Unified threads are being increasingly specified, particularly by the motor car industry. The recently-installed Wickman 1¾-in. 6-spindle automatic is fully occupied on chain conveyor components, high-pressure hydraulic pipe-line fittings, and other products. A steady demand is reported for Nascol brand Scrubushes, which have been developed to provide adequate thread length in sheet metal. The bushes are available in brass or steel, and with all standard British, American and Unified threads. The latest addition to plant at these works is a Revelation projector of 50 × magnification. This instrument, made by Autotrope, Ltd. (Salisbury, also provides for surface finish examination.

EDWARD HOLME & CO. (1931), LTD., Moss Lane, Altrincham, are occupied on a variety of electrical control panels and switchboards, including change-over contactor panels for emergency lighting purposes and automatic control gear, brakes, and solenoids for industrial applications. In the associated die casting foundry, work is in progress on aluminium, aluminium-bronze and brass parts for a variety of purposes.

H. FORDSMITH, LTD., Cornbrook, Manchester,

report a good demand for gib head, plain taper, and parallel keys, with or without round ends, and hollow-back keys of various sizes, also for solid and split taper pins, cotter and parallel pins, nuts and bolts, and screwed rodding for studs in various materials. A good business is also reported in mild-steel solid collars and split cast-iron collars, of both standard and special forms, and in spindles up to ½ in. diameter by 6 in. long, in mild steel, silver steel, and stainless and other alloy steels. Recent additions to the products manufactured include a range of fork-ends, and hydraulic pipe adapters up to 2½-in. B.S.P. Machining capacity has been augmented by the addition of Ward No. 7 and No. 8 combination turret lathes, a Pollard automatic drilling and tapping machine, and a B.S.A. centreless grinding machine, for work up to 6 in. diameter by 8 in. long. H. B.

The Novikov System of Gearing

Recent reports in the daily press about the success of a gear-tooth form of Russian origin should be considered only in conjunction with some knowledge of the history of toothed gearing.

The Russian tooth-form is distinguished from the almost universally-used involute form by the fact that a concave profile on one tooth makes contact with a convex profile on the mating tooth. In principle this gives an advantage in load capacity because a wider band of contact is produced by any particular yield of the surfaces under contact loading, but there is nothing new about it. The cycloidal tooth form (for example) long since abandoned for power-transmitting gears (as distinct from, say, clockwork gears) has this characteristic, and so have many other tooth forms that have been patented, tried and abandoned in the last hundred years or so.

The characteristics that have given the involute form its pre-eminence are:

(1) The basic simplicity of its geometry, which minimizes the difficulty of producing cutting tools of the necessary accuracy.

(2) The convex character of all tooth flanks, which minimizes the loss of load capacity that results from departures from ideal meshing conditions due to unavoidable imperfection in mounting the gears.

It has long been known that with very special care in manufacture and mounting, concave/convex tooth forms can give higher load capacity and lower friction loss than those of corresponding involute gears. Laboratory tests, in which the qualifying conditions can be guaranteed, are nearly sure to show that some appropriately chosen non-involute form has an advantage over the involute. On the strength of such results, non-involute teeth have sometimes been adopted for actual service, and initial performances have often agreed with the laboratory results, but subsequent experience has always led to a return to the involute. Even the involute, less affected as it is by service imperfections that are non-involutes, does not invariably work according to plan, and its more sensitive rivals are likely to be in much more frequent trouble.

It is fair to say, therefore, that in going into general production with one of the very numerous concave/convex tooth forms, in spite of their discouraging history, the Russians are carrying out a bold experiment, the progress of which will be watched with great interest. It is possible that modern standards of accuracy are high enough to enable a previously unsuccessful principle to justify itself in service. If it does, gear engineers will be ready to consider the question as to whether the advantages in load capacity and low tooth friction are great enough to outweigh the higher production-cost.

W. A. Tuplin, D.Sc., M.I.Mech.E.

Letters to the Editor

[The Editor does not hold himself responsible for the views expressed by his correspondents.]

Factors Affecting Performance in Cylindrical Grinding

(*To the Editor of* MACHINERY)

SIR,—Having read with interest the article under the above heading in MACHINERY, 93/24—2/7/58, I offer the following comments. The lack of reference to cracking is somewhat disturbing, as the grinding methods and practice advocated by Mr. J. A. Mueller combine to provide just those circumstances which, in my experience, are a prime cause of grinding cracks, particularly on carburized surfaces.

It has been noticed that heavy in-feed and hard wheels combined with oil-water emulsion as a grinding fluid tend to produce the conditions which result in grinding cracks. Experience has shown that in certain cases, particularly with carburized S.82 material, the lightest possible in-feed, together with the softest wheel practicable, are imperative for a crack-free finish. The grinding fluid is also extremely important and soluble oil has not given favourable results. In some instances, when removing existing grinding cracks and on deep-hardened surfaces, it has been found best to grind dry and in other cases cooling has been effected

with CO_2, pressurized water vapour, or a straight oil. These conditions are not conducive to high-speed production, but previously excessive scrap and salvage percentages have been greatly reduced. Some components, indeed, have been completely free from defects since such conditions were imposed. Consequently it can be shown that the best methods for high-speed production grinding are not always satisfactory for producing flaw-free components. In this connection, it is believed that the loss of time involved in the use of smaller infeeds is fully compensated by the reduction in costly scrap.

These comments on the article are submitted because it is thought that planning staffs may well use the information presented, and unless thought is given to the possibilities of cracking with high grade steels, such use might well prove dangerous and expensive.

J. M. D. WILDING,

Repair Section, Structures Department, Rotating Wing Design Department, Bristol Aircraft, Ltd.

Weston-Super-Mare

Molybdenum Disulphide Coated Files

As a result of tests carried out by William Jessop & Sons, Ltd., and J. J. Saville & Co., Ltd., both members of the B.S.A. group of companies, it has been shown that by treating files with a coating of molybdenum disulphide the cutting efficiency of certain types can be increased by as much as 60 per cent, and the former company is now marketing a range of files treated in this manner.

A number of untreated files, also files which had been coated with "dag" Product 1127 (colloidal molybdenum disulphide in alcohol) were tested on a Herbert file testing machine, and each face of each file was subjected to 30,000 strokes against a steel bar, a constant pressure being applied to the file throughout. The performance of each file was measured by the amount of steel which it removed from the block during the test.

A steel bar was used, having a Brinell hardness of 187, and the machine was set to give a 6-in. cutting stroke at a rate of 55 strokes per min. The file was held against the work area under a pressure of 31 lb. per sq. in. The comparative figures of length of metal removed from a 1-in. square test bar by untreated and treated 12-in. bastard files, were 9 and 10·2 in., respectively. For untreated and treated 12-in. smooth files, the corresponding figures were 0·8 and 1·2 in., when filing a 1 by ½-in. section steel bar under the same conditions.

Three-square 6-in., smooth, engineers' files were also tested in a similar manner. In this instance the test bar was of 1- by ½-in. section and had a Brinell hardness figure of 235. The machine was set for a 3-in. stroke, and after 30,000 strokes the metal removal figures were 0·6 and 1·0 in. for untreated and treated files, respectively.

The "dag" Product 1127, which is supplied by Acheson Colloids, Ltd., was diluted with toluene and is said to be particularly suitable for application to files as it requires no heat-curing treatment. It will be apparent from the figures quoted above that the greatest improvement in performance was obtained with the fine-toothed files, and it is suggested that the molybdenum disulphide coating acts as a parting agent between the filings and the teeth, thereby reducing clogging. The process would appear, therefore, to offer particular advantages for smooth files which are to be used on difficult, "clogging" materials.

New N.P.L. Computer

An improved and extended electronic digital computer has recently been completed at the National Physical Laboratory, Teddington, for the use of the N.P.L. Mathematics Division. Known as the ACE (Automatic Computing Engine), it will be of considerable assistance in the solution of problems associated, for example, with aircraft design and nuclear reactors.

The numbers and instructions on which it operates have 48 binary digits, equivalent to 14 decimal digits, and the working store consists of 800 such digit groups or "words," while the main store, consisting of four magnetic drums, will contain up to 32,768 words. Both magnetic tape and punched card equipment are provided for input and output. Input speed from cards is 7,000 binary digits per sec., with a rate of 450 cards per min. The electronic equipment is contained in 10 large cabinets arranged in an arc around the control console, each cabinet being fitted with an electrically-operated rising door to permit rapid access. Some 6,000 miniature electronic valves are incorporated. The console has some 160 keys and 300 signal lamps, and provides both audible indications and visual displays of computation.

As examples of the work done and speed of operation, the following may be quoted. The roots of a 16th degree polynomial may be obtained in an average time of 15 sec., and polynomials of degree up to about 250 may be solved. A set of simultaneous equations of order 30 may be solved in about 5 sec. Sets of simultaneous equations

containing no zero coefficients may be solved up to the 170th order.

The building of ACE represents a second stage in the development of computer design and research—a process which was began by the late Dr. A. M. Turing, F.R.S., who joined the staff of the Mathematics Division in 1945. Much of the work has been carried out by the Control Mechanisms and Electronics Division.

Electronic Wheel Truing Machine

The electronic bicycle wheel truing machine, shown in the accompanying illustration, which is being displayed on the stand of Phillips Cycles, Ltd., at the International Cycle and Motor Cycle Show at Earl's Court, has been developed by The British Cycle Corporation, Ltd., in conjunction with Tube Investments Technological Centre. A wheel, with the spokes in position but not tightened, is loaded into the machine by the operator. When a button is pressed, the tightening and truing cycle is then completed entirely automatically in a time of 1 min.

After the wheel has been placed in the machine, it is automatically lowered horizontally on to a bed where it is surrounded by a ring of 40 electric motors. These motors are individually controlled, and each tightens one spoke. When spanners driven by these electric motors have been applied to the spoke nipples, a magnetic sensing head, carried on the end of an arm, is lowered and rotated at high speed just above the rim of the wheel. This head scans the rim through the operation and detects any divergence from circularity.



Electronically-controlled machine for tightening spokes and truing bycycle wheels

Information from the magnetic head is fed into two control cubicles at the rear of the machine where it is translated by electronic devices and "instructions" are issued whereby each of the motors is controlled. The machine is so designed that the only forces acting on the rim are those imposed by the spokes. Consequently no distortion occurs when the wheel is removed.

The spokes are tightened to provide the correct overall tension and after truing has been completed, the magnetic head continues to rotate for a short period for final checking. Rotation then stops and the head is withdrawn. Subsequently, the spanners are rotated slightly to free the nipples, and the wheel is released ready for removal by the operator.

On account of variations in the rim dimensions, it is necessary for the machine to determine the tensioning limits before each operation is begun. Wheels are held true within 0·030 in., and it is pointed out that the operation is completed in a much shorter time than is possible for a highly skilled wheel builder, and with greater accuracy.

George Cohen Films

During the period of the Public Works and Municipal Services Exhibition, held recently at Olympia, London, George Cohen Sons & Co., Ltd., Wood Lane, London, W.12, gave a reception in the Olympia Restaurant, at which three new films were presented.

In the first of these films are shown the various stages in the erection of two sizes of the French-built Pingon range of travelling tower cranes, for which the company has recently been appointed agent in this country. These cranes are built in six basic sizes which will handle loads up to 5 tons, and have working radii up to 99 ft. A type P.45 crane, it may be noted, was used recently in connection with the construction of a 205-ft. high office building at Eastbourne Terrace, Paddington, London. In the film, particular attention is drawn to the patented sliding axle arrangement which enables the crane to be traversed on curved guide rails of exceptionally small radius.

The second film is concerned with the Swedish-made Hiab hydraulic lorry loader, also handled by the company in this country. Available with lifting capacities of 1 and 2 tons, the unit is intended for mounting on the chassis of a lorry behind the driver's cabin, and in addition to normal loading and unloading duties, it may be employed, for instance, for removing gas and water pipes from the lorry and laying them in a prepared trench in the ground, without using a separate crane.

Sequences in the third film indicate some of the lifting duties that are being undertaken, by different companies, with Jones KL 10-10 "fast travel" mobile cranes. This crane was described in MACHINERY, 90/1186—24/5/57.

The Importance of Appearance in Heavy Engineering

(*Continued from page* 1211)

justified because "when machines are equal from a technical point of view, the machine of better appearance is preferred even if the cost is higher." Apart from being more saleable, the well-designed machine offered advantages in service. Since it presented to the operator a clear picture, unconfused by shafts, gears, and control leakages. Concentration was thus assisted, risk of mistakes and accidents was reduced, and enclosed mechanisms were protected from dirt and less subject to wear.

If the importance of appearance is accepted, also the fact that good design, in this respect, may be by no means easy to achieve with no sacrifice of efficiency or maintenance facility, it is evident that more thought must often be given in the future to the means whereby the desired result is to be obtained. Various alternatives were mentioned at the conference and one speaker sugested that the machine designer should have a feeling for good appearance and the ability to see a picture of the completed machine in his mind when he is designing it. To this end managements should determine which designers already had an instinct for good appearance and could be further trained. As a contribution to this training, it was advocated in another paper that the designer should be given as much opportunity as possible to meet the customers on their own ground. "Let him run the gauntlet of the plant engineers and maintenance men, in other words throw him to the lions." The author of a third paper contended that the designer draughtsman should not be expected also to fulfil the duties of appearance designer, but that the two should work in close collaboration when the first layout of a new machine was made. This latter view was supported by a fourth speaker, who considered that an industrial designer, who might be a member of the staff or an outside consultant, was essential in a product design team.

Whichever course may be adopted in any particular circumstances, once the value of good industrial design is appreciated, it will be found that substantial improvements in appearance can often be obtained, which may influence, indirectly, the efficiency of both the machine and the operator.

Birmingham Mechanical Engineers

The annual dinner and dance of the Birmingham Association of Mechanical Engineers was held recently at the Botanical Gardens, Edgbaston, Birmingham. More than 200 members and guests were welcomed by the president of the Association, Mr. E. T. Teasdale, A.M.I.Prod.E., and Mrs. Teasdale. The principal guest, Sir Edward W. Thompson, J.P., in proposing the toast of "The Association," pointed out that it was approaching its 70th Anniversary and was closely connected with many branches of engineering in the Birmingham area. There was a greater need than ever, Sir Edward said, for engineers to get together and exchange ideas, and he wished the Association continued success in its important work. Mr. E. T. Teasdale responded, and thanked the speaker for his good wishes. A toast to the guests was proposed by Mr. R. H. Hancock, M.I.Prod.E., M.I.I.A., immediate past president of the Association, who extended a particular welcome to Mr. F. W. Witt, the president, and Mr. W. A. Mann, the secretary, of the London Association of Engineers. Mr. B. R. Munson replied to the toast on behalf of the visitors. Mr. Teasdale extended special thanks to Mr. G. B. Crosthwaite, of the Association, for his work as hon. social secretary.

Coming Events

INSTITUTION OF ELECTRICAL ENGINEERS.—*East Midland Centre.* December 4, at 7.15 p.m., at the De Montfort Hall, Leicester; and *South Midland Centre.* December 2, at 7 p.m., at the City of Birmingham Town Hall; Faraday lecture on "Automation," by H. A. Thomas, D.Sc.

INSTITUTION OF PRODUCTION ENGINEERS.—*London Section.* December 4, at 7 p.m., at Powers Samas Accounting Machines, Ltd., Aurelia Road, Croydon, Surrey; lecture on "Punched Cards and Automation," by D. F. Nettell, B.Sc. *Western Section.* December 3, at 7.30 p.m., in the Small Lecture Theatre, Bristol University; lecture on "Materials Handling—A Challenge to British Industry," by A. G. Hayek.

THE PLASTICS INSTITUTE. *North-Western Section.* December 5, at 6.45 p.m., at the Textile Institute, Blackfriars Street, Manchester; lecture on "Some Aspects of the Application and Fabrication of Industrial Laminates," by S. F. Sandford.

INCORPORATED PLANT ENGINEERS.—*Southern Branch.* December 3, at 7.30 p.m., at the Royal Beach Hotel, Southsea; paper on "Safety in the Use of Electricity," by S. J. Emerson.

Industrial Notes

THE BRITISH THOMSON-HOUSTON EXPORT CO., LTD., has moved to 33 Grosvenor Place, London, S.W.1 (telephone number, Belgravia 7011).

THE INSTITUTE OF INDUSTRIAL SUPERVISORS, 24 Albert Street, Birmingham, 4, have drawn our attention to the fact that November 27 will be the 10th anniversary of the inaugural meeting. An article concerned with the Institute and its progress appears in the current issue of *The Supervisor*, under the heading: "Ten Years of Achievement."

THE NELSON ENGINEERING CO., LTD., Netherfield Road, Nelson, Lancs., inform us that, by mutual agreement, the arrangement whereby Verity's, Ltd., acted as their sales representatives has been terminated. In future the company's products will be marketed direct from the above address.

COMBINED OPTICAL INDUSTRIES, LTD., Slough, Bucks., inform us that their spectacles with plastics lenses have been approved by a sub-committee advising the Inspector of Factories for use in industries where protection must be provided for workers' eyes, against flying particles of metal or abrasive.

NORRIS-TINKER ENGINEERING CO., LTD., 253 Putney Bridge Road, London, S.W.15, have forwarded a leaflet drawing attention to the credit finance facilities which they are offering in connection with the rebuilding of customers' machine tools. Under this scheme, the cost of re-building can be spread over periods up to 24 months, in accordance with individual requirements.

INSLEY (LONDON), LTD., 21-22 Poland Street, London, W.1, are now marketing a range of Nadella needle bearing cam follower rollers of compact design. The outer races, which form the actual followers, may have cylindrical or convex surfaces. Standard sizes range from 0·75 to 2·44 in. outside diameter, and the larger rollers are supplied with inner rings and oil holes.

THE LIGHTFOOT REFRIGERATION CO., LTD., Abbeydale Road, North Circular Road, Wembley, Middlesex, and GESELLSCHAFT FUR LINDE'S EISMASCHINEN A.G., Wiesbaden, Germany, have signed an agreement for mutual collaboration, whereby the full range of products and technical resources of each company in the field of domestic and industrial refrigeration and air conditioning will be made available to the other.

BROWN & WARD MAGAZINE BAR FEED.—In MACHINERY, 93/1145—12/11/58, reference was made to a leaflet describing the automatic, electric, magazine bar feed introduced by Brown & Ward (Tools) Ltd., Hatherton Lane, Walsall, Staffs., and it was stated that there were two types for maximum stock lengths of 8 ft. and 10 ft. We are informed that the figures are incorrect and that the capacities are 10 ft. and 12 ft.

THE ELECTRICAL DEVELOPMENT ASSOCIATION, 2 Savoy Hill, London, W.C.2, as part of a campaign to encourage the extended use of electricity by industry, is inserting a series of advertisements in numerous trade and industrial journals, in the form of illustrated data sheets. These sheets are concerned, for example, with electro-heat, induction heating, resistance heating, light-sensitive cells, and industrial lighting, and copies can be obtained on application to the above address.

ROBALLO ENGINEERING CO., LTD., 43 Dover Street, London, W.1, are marketing, exclusively, Roballo ball bearing slewing rings which are being manufactured at Crown Works, Sunderland. These rings were described in MACHINERY, 91/1435—20/12/57, and it may be recalled that there are two types, one of which comprises a single row of balls and two ring components, and the other, a double row of balls and three ring components.

SAFETY COLOURS FOR INDUSTRY.—Since the publication last year, of B.S. 2929, on safety colours for use in industry, the attention of B.S.I. has been drawn to the fact that use of a green cross, as recommended, to indicate first-aid goods and equipment, might possibly be considered as an infringement of certain registered trade marks. To avoid any risk of confusion the standard is therefore being amended. It will now recommend that location of first-aid equipment should be indicated by the use of the words "First Aid" printed in bold white capital letters on a green rectangular background.

COURSES FOR TECHNICAL REPRESENTATIVES are to be held at the College of Technology, Gosta Green, Birmingham, 4. They will be of six weeks' duration, and will provide for organized studies of those aspects of a company's activities which must be understood by technical representatives in the field, including product development, production control, and accounting. More than half of each course will be devoted to case study and project work, also interrogation meetings with people possessing varied experience in customer relations. The first course will start on February 16, and full particulars can be obtained from the Department of Industrial Administration at the above address.

HAMBLING INDUSTRIES, LTD., Terminus Road, Chichester, Sussex, inform us that certain items of machine tool equipment which have been developed for use in their own works and those of other companies in the Ayling Group are now being placed on the market. These items include the Offen centre locator, which can be employed on milling and drilling machines and lathes. It is stated that it will indicate the relationship between a spindle centre line and a datum face within 0·0005 in. by the "run-off" method, or 0·0002 in. by the "light-line" method. In addition there are two vices which are precision ground on all external surfaces, the maximum error for squareness being held within 0·0004 in. per inch. A dovetailed slide construction ensures rigidity and parallel location of the jaws.

Machine Tool Exports and Imports

EXPORTS OF MACHINE TOOLS

Type of Machine	Month ended August 31, 1958	Eight months ended August 31	
		1957	1958
	Value £	Value £	Value £
New, complete—			
Boring machines:			
Vertical	66,155	285,898	407,178
Other	33,197	663,416	527,836
Drilling machines	70,216	1,435,796	1,207,034
Grinding (excluding thread grinding), lapping and honing machines	219,703	1,816,057	1,546,524
Lathes:			
Automatic	136,050	1,408,905	916,843
Capstan	113,517	1,818,050	1,362,089
Other	166,218	2,321,413	1,840,627
Screwing machines	7,728	161,277	174,943
Threading machines	22,394	410,158	231,669
Milling machines (excluding thread milling and gear cutting machines)	165,839	1,695,160	1,607,555
Planing, shaping and slotting machines	25,247	556,127	570,919
Presses:			
Hydraulic	190,330	964,304	626,761
Other	83,445	630,478	887,809
Punching and shearing machines	19,470	317,731	303,066
Other plate and sheet metal-working machines including straightening rolls	30,969	254,927	498,103
All other machines	263,445	2,082,854	1,982,782
Used machines, complete	67,622	567,485	533,939
Parts	169,153	1,564,011	1,417,264
Total	1,850,698	18,954,047	16,642,941
Destination			
Union of South Africa	134,097	1,062,480	1,197,123
India	302,252	2,387,078	2,756,420
Australia	263,345	2,797,183	2,437,984
New Zealand	23,080	283,314	258,430
Canada	68,677	1,379,291	1,092,050
Other Commonwealth countries	114,902	1,097,520	1,202,770
Soviet Union	—	792,478	72,878
Sweden	21,965	565,174	379,445
Western Germany	19,377	644,930	339,391
Netherlands	50,691	560,878	391,077
France	156,540	1,472,002	1,358,289
Spain	83,378	1,014,960	1,017,659
Italy	118,669	605,489	627,682
U.S. America	87,523	1,826,621	851,401
Other foreign countries	406,202	2,464,649	2,660,342

IMPORTS OF MACHINE TOOLS

New, complete—			
Boring machines	63,007	1,700,265	762,117
Drilling machines	6,419	287,783	124,857
Gear-cutting machines	34,139	708,502	436,273
Grinding, lapping and honing machines	158,655	1,479,419	1,693,378
Lathes:			
Automatic	149,366	1,435,918	1,573,038
Other	9,637	156,372	157,768
Milling machines	88,524	1,742,784	1,224,828
Planing, shaping and slotting machines	1,162	210,357	160,063
Presses	54,741	582,564	596,017
All other machines	263,494	3,468,028	2,888,254
Used machines, complete	29,358	247,945	324,735
Parts	285,309	2,752,916	2,313,634
Total	1,143,811	14,772,853	12,254,962
Country of Origin			
Western Germany	479,441	5,612,412	4,405,711
Switzerland	200,332	1,800,400	1,890,385
U.S. America	228,761	5,133,121	3,669,137
Other foreign countries	235,277	2,226,920	2,289,729

Trade Publications

WELWYN TOOL CO., LTD., Welwyn Garden City, Herts. —Folder giving particulars of the ranges of Drei-S-Werk piercing punches, "plunging" punches, locating pins and ejectors for press tools, die casting dies, and injection and compression moulds. The company holds the sole agency for these items in Great Britain.

BRITISH NYLON SPINNERS, LTD., Promotion Department, 68 Knightsbridge, London, S.W.1. Illustrated brochure concerned with the advantages of nylon overalls for various industrial applications. Some case histories are included, also notes on washing and stain removal.

TWIFLEX COUPLINGS, LTD., The Green, Twickenham, Middx. Catalogue No. TT6-1257 gives rating and dimensions of the range of articulated-type and Flexilink couplings which are suitable for marine and industrial drives. Another publication describes the principle of operation and range of industrial applications for the Twiflex disc brake, which incorporates Dunlop caliper units.

CREED & CO. LTD., Telegraph House, Croydon, Surrey. Folder No. DP.3 is concerned with the type 90 tape verifier which is intended for checking the accuracy of punched tape prepared for use in conjunction with data processing and automation systems. The machine can also be used as a perforator for preparing 5-track tapes either singly, or two at a time.

The Price of a Subscription to MACHINERY is 52 Shillings per annum, post free, to any part of the world.

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26/11/58

Personal

ADMIRAL SIR RALPH A. B. EDWARDS, K.C.B., C.B.E., has joined the board of Elliott Bros. (London), Ltd., Lewisham, London, S.E.13.

MR. S. W. J. SIMPSON, B.Com., has been appointed sales manager of Aldridge Tool & Engineering Co., Ltd., Aldridge, nr. Walsall, Staffs.

MR. PETER GOULD has been appointed technical sales representative in the Eastern Area for British Central Electrical Co., Ltd., Briticent House, 6/8 Rosebery Avenue, London, E.C.1.

MR. K. ARCHER, A.M.I.Prod.E., has been appointed sales manager of Lenchs (Birmingham), Ltd., Great Hampton Street, Birmingham 18. A large extension to the works has recently been completed, whereby productive capacity has been substantially increased.

MR. JOHN SMITH, J.P., A.M.C.T., M.I.Mech.E. A.M.I.Mar.E., has been appointed technical director of Petters, Ltd., Staines, Middlesex. He was previously technical director of the National Gas & Oil Engine Co., Ltd., Ashton-under-Lyne.

MR. GRAHAM ALMROTT has been appointed a director of Caterpillar Tractor Co., Ltd., 55 St. James's Street, London, S.W.1, but will continue to be responsible for operations at the Leicester plant. He joined the company in 1951, shortly after its formation.

MR. JOHN G. WILSON, general sales manager of Universal Metal Products, Ltd., Langley Road, Salford, 6, Lancs., has been elected a director of the company. Mr. J. Kenyon, sales manager of the Plastics Division, has been appointed general manager of that Division.

MR. C. P. SEAGER has been appointed industrial truck sales manager for Ransomes, Sims & Jefferies, Ltd., Orwell Works, Ipswich. For most of his 34 years with the company Mr. Seager has been a member of the truck sales office, and since July, 1956, he has been assistant manager of the department.

MR. D. HUTTON, A.M.I.Mech.E., has been appointed assistant superintendent, switchgear department; MR. V. D. SWAIN, B.Sc.(Eng.), assistant superintendent, control department; MR. F. G. ROSE, assistant superintendent, main production; and MR. K. R. JOHNSTON, B.Sc.(Eng.), assistant superintendent, plant department, of Metropolitan-Vickers Electrical Co., Ltd., Trafford Park, Manchester, 17.

MR. E. FOLEY, after nearly 54 years' service with Kendall & Gent, Ltd., Gorton, Manchester, retired recently but retains his seat on the board of directors. He joined the company in 1905 as an apprentice draughtsman, and on completion of his apprenticeship, he had a brief period with the Churchill Machine Tool Co., Ltd., Manchester, returning to Kendall & Gent, Ltd., in 1912. He became assistant chief draughtsman in 1914 and chief draughtsman in 1927. Mr. Foley's extensive travels on behalf of the firm have included two visits to Moscow and several visits to Canada. In 1945 he was appointed a technical director of the company.

MR. A. T. COPE has been appointed as an additional sales engineer for Rockwell Machine Tool Co., Ltd. He will operate, from the Midlands office, in the North Birmingham and Black Country area. Mr. Cope was formerly with Charles Churchill & Co., Ltd. MR. W. H. G. HERON has been transferred from the Rockwell office in Birmingham to Nottingham, and will cover the Nottingham and Peterborough area.

MR. J. WORSFOLD has been appointed a machine tool specialist by Kerry's (Great Britain), Ltd., Warton Road, Stratford, London, E.15. He will operate from the company's Perivale branch, and will cover Berks., Bucks., parts of Herts., and Middlesex. MR. R. W. SMORLEY holds a similar appointment, and, operating from the Stratford branch, will cover East London, Essex, and parts of East Herts. MR. E. F. RODWELL, also operating from the Stratford branch, will cover North London, and parts of Herts. and Beds. in a similar capacity.

Books Received

CASTING IN STEEL. Published on behalf of the British Steel Founders' Association by Sir Isaac Pitman & Sons, Ltd., Parker Street, W.C.2. 112 pp. [Price 18s. 0d. net.]

Various aspects of steel casting that were previously covered by the BSFA Bulletins are discussed in this book, and information is provided which will enable the process to be properly and economically applied. Amongst the matters considered are feed heads, cores, effects of sharp radii, hot tears and pulls, moulding, core making, mould closing, and fettling. Other sections are concerned with welding a steel casting, heat treatment, general inspection, non-destructive testing, and technical controls in steel, founding. A list of relevant British Standards is included, also a glossary of steel foundry terms. The text is fully and clearly illustrated.

Obituary

MR. C. DONALD RUSHWORTH, a director of Rushworth & Co. (Sowerby Bridge), Ltd., Clough Works, Sowerby Bridge, Yorks, whose principals are Morrison Marshall & Hill, Ltd., died on November 18 aged 52. He was a grandson of the firm's founder, the late C. D. Rushworth, and a son of the late Mr. C. W. Rushworth and was also a director of Graham & Normanton, Ltd., Halifax, Darling & Sellars, Ltd., Keighley, and A. Kinghorn & Co., Ltd., Todmorden.

Correction

IN MACHINERY, 93/1147—12/11/58, it was stated that Mr. J. Urpeth, who has been appointed Midlands representative for the Amar Tool & Gauge Co., Ltd., was previously with C. E. Johansson, Ltd. We are asked to point out that Mr. Urpeth was, in fact, a technical representative for A. P. Warren, Ltd., Carl Edvard House, Sheen Road, Richmond, Surrey, who are distributing agents for C. E. Johansson, Ltd.

Machine Tool Share Market

Stock markets were mainly firm during the period under review, but turnover, although still good, was on a reduced scale, and buying interest was more selective.

The gilt-edged section, after remaining relatively steady became unsettled owing to persistent small selling of British Government stocks, but investment support at the lower levels resulted in some improvement towards the close of the period.

With slackening of activity, the trend in the industrial share market was somewhat irregular. Early firmness gave place to slightly easier conditions, but near the end an improving tendency developed.

Among machine tool issues, Broom & Wade advanced 6d. to 12s.; John Holroyd "A," 6d. to 14s.; Kayser Ellison, 6d. to 47s.; Coventry Gauge & Tool, 1s. to 18s.; B. & S. Massey, 3d. to 9s. 9d.; Modern Engineering, 1s. 3d. to 10s. 9d.; and Thos. W. Ward, 1s. to 80s. 9d. On the other hand, Armstrong Stevens lost 4½d. at 8s. 9d.; Craven Bros. Manchester), 4½d. at 8s.; Asquith Machine Tool, 3d. at 24s. 3d.; Scottish Machine Tool, 3d. at 5s. 3d.; Chas. Churchill, 1½d. at 6s. 7½d.; British Oxygen, 6d. at 45s.; Churchill Machine Tool, 6d. at 17s. 9d.; Tap & Die Corporation, 6d. at 7s. 6d.; Jones & Shipman, 1s. at 21s.; and Ambrose Shardlow, 1s. at 44s. 6d.

SCOTTISH MACHINE TOOL CORPORATION.—Interim dividend 3 per cent (same).

Mond Nickel Fellowships

The Mond Nickel Fellowships Committee recently announced the award of Fellowships for 1958 to the following applicants:—Mr. G. H. Longworth (Lancashire Steel Manufacturing Co., Ltd.)—to study the manufacture of plain carbon and alloy steels for rod and wire products, in the United Kingdom, on the Continent and in the United States. Mr. J. C. Morrison (Carron Company)—to study melting, moulding and heat treatment of alloy cast irons, quality control of metal and sand plants in modern foundries, and new developments in related metallurgical processes. Mr. T. Tait (Colvilles, Ltd.)—to study the technical and economic factors involved in the use of oxygen in steel industries in the United Kingdom, on the Continent, and in the U.S.A. and Canada.

Applications are now invited for Fellowships of an approximate value of £900 to £1,200 for 1959. Particulars and forms of application are available from: The Secretary, Mond Nickel Fellowships Committee, 4 Grosvenor Gardens, London, S.W.1.

COMPANY		Denom.	Middle Price
Abwood Machine Tools, Ltd.	Ord.	1/-	9d.
Armstrongs, Stevens & Son, Ltd.	Ord.	5/-	8/9
Allen (Edgar) & Co., Ltd.	Ord.	£1	38/-
" " "	5% Prf.	£1	15/6*
Arnott & Harrison, Ltd.	Ord.	4/-	15/6
Asquith Machine Tool Corp., Ltd.	Ord.	5/-	24/3
" " "	6% Cum. Prf.	£1	18/6
Birmingham Small Arms Co., Ltd.	Ord.	£1	35/-xd
" " "	5% Cum. "A" Prf.	£1	15/3
" " "	6% Cum. "B" Prf.	£1	18/-
" " "	4% 1st Mort. Deb.	Stk.	88½
British Oxygen Co., Ltd.	Ord.	£1	45/-
" " "	6½% Cum. Prf.	£1	22/-
Brooke Tool Manufacturing Co., Ltd.	Ord.	5/-	4/-
Broom & Wade, Ltd.	Ord.	5/-	12/-
" "	6% Cum. Prf.	£1	17/9
Brown (David) Corporation Ltd.	5½% Cum. Prf.	£1	15/6xd
Buck & Hickman, Ltd.	6% Cum. Prf.	£1	17/9
Butler Machine Tools Co., Ltd.	Ord.	5/-	8/-
" " "	5% Cum. Prf.	£1	13/9
C.V.A. Jigs, Moulds & Tools, Ltd.	5½% Red. Cum. Prf.	£1	11/3
Churchill (Charles) & Co., Ltd.	Ord	2/-	6/7½
" " "	6% Cum. Prf.	£1	26/4½
Churchill Machine Tool Co., Ltd.	Ord.	5/-	17/9
" " "	6% Cum. Prf.	£1	18/3
Clarkson (Engrs.), Ltd.	Ord.	5/-	15/3
Cohen (George), Son & Co., Ltd.	Ord.	5/-	10/6
" " "	4½% Cum. Prf.	£1	14/6
Coventry Gauge & Tool Co., Ltd.	Ord.	10/-	18/-
" " "	5% Cum. Red. Prf.	£1	16/3
Coventry Machine Tool Works, Ltd.	Ord.	4/-	8/6
Craven Bros. (Manchester), Ltd.	Ord.	5/-	8/-
Elliott (B.) & Co., Ltd.	Ord.	1/-	3/-
" "	4½% Red. Cum. Prf.	£1	13/9
Expert Tool & Case Hardening Co., Ltd.	Ord.	2/-	1/3
Firth Brown Tools, Ltd.	4% Cum. Prf.	£1	12/6
Greenwood & Batley, Ltd.	Ord.	£1	52/6
Harper (John) & Co., Ltd.	Ord.	5/-	16/6
" "	4½% Red. Cum. Prf.	£1	13/-
Herbert (Alfred), Ltd.	Ord.	£1	37/6
Holroyd (John) & Co. Ltd.	"A" Ord.	5/-	14/-
" " "	"B" Ord.	5/-	13/6
Jones (A. A.) & Shipman, Ltd.	Ord.	5/-	21/-
" " "	7% Cum. Prf.	5/-	5/-
Kayser, Ellison & Co., Ltd.	Ord.	£1	47/-
" " "	6% Cum. Prf.	£1	18/3
Kendall & Gent, Ltd.	Ord.	5/-	7/-
Kerry's (Gt. Britain), Ltd.	Ord.	5/-	6/10½
Kitchen & Wade, Ltd.	Ord.	4/-	8/3xd
Martin Bros. (Machinery), Ltd.	Ord.	2/-	1/6
Massey, B. & S., Ltd.	Ord.	5/-	9/9
Modern Engineering Machine Tools Ltd.	Ord.	5/-	10/9
Newall Engineering Co., Ltd.	Ord.	2/-	4/9
Newman Industries, Ltd.	Ord.	2/-	2/9
" " "	6% Prf. Ord.	5/-	5/6
Noble & Lund, Ltd.	Ord.	2/-	3/9
Osborn (Samuel) & Co., Ltd.	Ord.	5/-	20/-xd
" " "	5½% Cum. Prf.	£1	26/-
Pratt (F.) & Co., Ltd.	Ord.	5/-	22/9
Scottish Machine Tool Corporation, Ltd.	Ord.	4/-	5/3
Shardlow (Ambrose) & Co., Ltd.	Ord.	£1	44/6
Shaw (John) & Sons, Wolverhampton, Ltd.	Ord.	5/-	14/6
Sheffield Twist Drill & Steel Co., Ltd.	Ord.	4/-	13/6
" " "	5% Cum. Prf.	£1	15/-
Stedall & Co., Ltd.	Ord.	5/-	7/6
Sykes (W. E.), Ltd.	"B" non-voting Ord.	10/-	22/6
Tap & Die Corporation, Ltd.	Ord.	5/-	7/6
" " "	4½% Deb. 1961-1977	Stk.	82/-xd
Wadkin, Ltd.	Ord.	10/-	18/9
Ward (Thos. W.), Ltd.	Ord.	£1	80/9
" "	5% Cum. 1st Prf.	£1	16/-
"	5% Cum. 2nd Prf.	£1	24/-
Willson Lathes, Ltd.	Ord.	1/-	2/4½

The Middle Prices given in the list are in several cases nominal prices only and not actual dealing prices. Every effort is made to ensure accuracy, but no liability can be accepted for any error. * Sheffield price. † Birmingham price.

PRICES OF MATERIALS

All prices per ton except where otherwise stated.

Pig-Iron

Foundry and Forge No. 3, Class 2

Middlesbrough zone	£21 6 0
Birmingham	£20 18 3

Phos. over 0·1 up to 0·75%

Birmingham	£23 17 0

Scottish Foundry

Grangemouth	£25 3 6

Hæmatite

English No. 1	
N.E. and N.W Coast	£25 6 6
Scotland	£25 13 0
Sheffield	£26 15 0
Birmingham	£27 4 0
Welsh	£25 6 6

Steel Products

Medium plates	£45 11 6
Mild steel plates, ordinary*	£42 2 0
Boiler plates*	£44 12 0
†Flat bars 5 in. wide and under †Round bars under 3 in.	£40 0 6
Billets, rolling quality, soft U.T.	£32 15 6

Phosphor Bronze

Ingots (288) (A.I.D.) d/d	£285 0 0

Copper

Cash (mean)	£234 17 6
Cold rolled and hot rolled sheets 4 ft. by 2 ft. by 10 SWG	£310 0 0—£310 5 0
Rods ⅜ in. to ¾ in. diam.	£325 15 0
Tubes, 1½ in. bore by 10 SWG, ton lots, per lb.	3s. 1⅛d.
Wire rod, black, hot-rolled (½–⅜ in.)	
‡ English	£255 7 6

Zinc

Refined, minimum 98 per cent. purity, current month (mean)	£72 12 6

Brass

Tubes, solid drawn, per lb.	1s. 10⅛d.
Strip 63/37, 6 in. by 10 SWG coils, ton lots	£256 5 0—£259 5 0
Rods, ½-3in. diam. (59 per cent copper)	2s. 0½d.

Yellow Metal

Condenser plates, per ton	£194 0 0
Rods, per lb.	2s. 1½d.

Aluminium

Ingots min. 99·5 per cent Canadian d/d	£180 0 0

Lead

Refined, minimum 99·97 per cent purity, current month(mean)	£77 7 6

Tinplates

‡U.K. Home trade:	
Handmill f.o.t. makers' works	£3 11 8½
Cold reduced, f.o.t. makers' works	£3 7 4½
U.K. Export:	
Hot rolled basis, f.o.t. works' port	72s. 6d.—75s. 0d.
Cold reduced basis, f.o.t. works' port	75s. 0d.

Gunmetal

Ingots, 85.5.5.5. ex works	£192 0 0

* N.E. Coast, N. Joint Area, Central Scottish Zone.
† U.T. soft basic.
‡ Official maximum price, after allowing for adjustments for increase in price of tin.

MAKERS' PRICES

Hexagon Steel Bars[1]

Sizes in inches from 1 in. up to 2·21 and 2·41 a/f, ex works 2 ton basis	£42 17 0
Free cutting black	£47 6 6

Reeled Steel Bars[1]

Single-reeled 1½ in. upwards, f.o.t. works (+ usual extra for sizes)	£43 9 6
Free cutting	£47 19 0

Precision-ground Mild Steel[2]

1-in. dia. + 0·00025-in. 4-ton lots, per cwt.	121s. 6d.

Bright Ground tainless Steel Bars[3]

EN56AM (martensitic, free cutting)	£285
EN58AM (austenitic, free cutting)	£353

High-Speed Steel

Black random length bar. All prices basic, per lb., subject to extras.

Molybdenum " 66 "	5s. 10d.
Molybdenum " 46 "	5s. 8d.
14 per cent tungsten	5s. 6d.
16 per cent tungsten	5s. 10d.
18 per cent tungsten	6s. 0d.
22 per cent tungsten	7s. 0d.
5 per cent cobalt	9s. 1d.
4·75/5·25 molybdenum + 6·0/6·75 tungsten + 1·75/2·05 vanadium per cent (5-6-2)	6s. 0d.

Precision-ground, High-speed Free-turning Brass Rod[2]

⅜-in. dia. ± 0·00025-in. 2-ton lots, per lb.	2s. 8⅜d.

Grey Iron Rod

Die Cast[4] in random lengths 18 in. to 26 in. rough machined ⅛-in. above listed size. Extra for definite lengths. Discounts for orders over £150.

	Per cwt. net. Mark I	Mark III
⅜ or ½in.	245s. 4d.	318s. 10d.
1 or 1¼ in.	196s. 4d.	251s. 10d.
1½ to 1¾ in.	137s. 10d.	171s. 2d.
1⅞ to 2 in.	106s. 2d.	125s. 11d.
2⅛ to 3½ in.	91s. 6d.	106s. 4d.
3⅝ to 12 in.	86s. 6d.	99s. 2d.

Continuous Cast

10-ft. lengths, centreless machined 1 to 3-in. dia. + 0·010 to 0·020 in., prices as quoted for die cast bar[4]

6-ft. lengths centreless ground + 0·010 in. Extra for hardenable alloy iron[5] Per cwt. net	⅜ or ½ in.	245s. 4d.
	1 or 1¼ in.	196s. 4d.
	1½ to 1¾ in.	137s. 10d.
	1⅞ to 2 in.	106s. 2d.
	2⅛ to 3½ in.	91s. 6d.

Stellite[6]

Welding Rods plain

¼ in. dia. per lb.	30s. 0d.

Toolbits

¼ in. sq. × 4 in., each	22s. 3d.

1 Colvilles, Ltd., Glasgow, and 17 Grosvenor Street, London, W.1. 2 Pratt, Levick & Co., Ltd., Chester, 3 Spartan Steel & Alloys, Ltd., St. Stephens Street, Birmingham, 6. 4 Sheepbridge Alloy Castings, Ltd., Sutton-in-Ashfield. 5 " Flocast," Harold Andrews Sheepbridge, Ltd., Halesowen, 6 Deloro Stellite, Ltd., Highlands Road, Shirley, Solihull.

BASIC PRICES FROM LONDON STOCK[6]

Free Cutting Steel

Bright cold drawn: (Usaspead) over 1½ to 2 in.	£59 17 6
Lead bearing (Usaled)	£64 4 0
Precision ground, 1½ in.	£81 13 6

Bright Drawn

M.S. bars (M.M.C.) over 1½ in. to 2 in.	£55 3 6
Square edge flats (Usaflat)	£72 0 0
M.S. angles (Usaspead)	£99 10 0
Casehardening (EN) (Usacase) over 1½ in. to 2 in.	£63 9 6
M.S. bars (EN3B) (Usamild) over 1½ to 2 in.	£57 3 6
Carbon manganese semi-freecutting case hardening (EN202) (Usaspead 202) over 1½ to 2 in.	£72 19 0
35/45 ton tensile (EN6) (Usen) over 1 to 1½ in.	£64 17 6
0·4 Carbon Normalised (Usaspead " 40 ") over 1½ in. to 2 in.	£66 19 6
Carbon manganese steel to Specification EN.16.T (Usaspead 5565), per ton	£127 11 3

Ground Flat Stock

18-, 24-, and 36-in. lengths (Usaspead). List prices less 5 per cent

Oil Hardening Cast Steel

Non-shrink (Usaspead N.S.O.H.) ¾ in. to 2½ in., per lb.	1s. 11d.
Non-distorting heavy duty (Usaspead H.C.H.C.) ½-in. to 2½-in., per lb.	4s. 2d.

Silver Steel

(0·194-in. to 1½-in.) Genuine Stubs quality, per lb.	4s. 6d. less 27½%
M.M.C. quality, per lb.	2s. 5d. + 6½%
Boxes of 16 assorted sizes 1/32-in. to ½-in. dia.	7s. 6d.

Stainless Steel

K.E. 40.AM (Freecutting), per lb.	3s. 3½d.

Glacier Machined Bronze Bars

Phosphor bronze (288) Lead bronze	Prices on application

High-speed Steel

18 per cent tungsten. Prices on application.

Toolholder bits:	
Usaspead " Super " " " Supreme " " Cobalt 10	List price

Shimstock

Steel assorted, per tin	3s. 6d
Brass " "	7s. 3d.

6 Macready's Metal Co., Ltd., Pentonville Road, N.1. Subject to confirmation by London Office. Delivered free by van in London area.



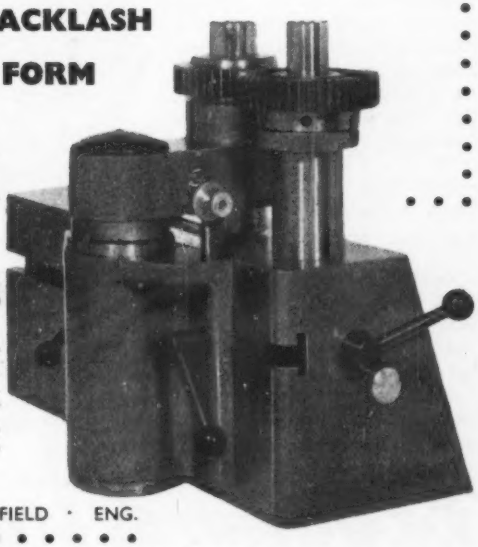
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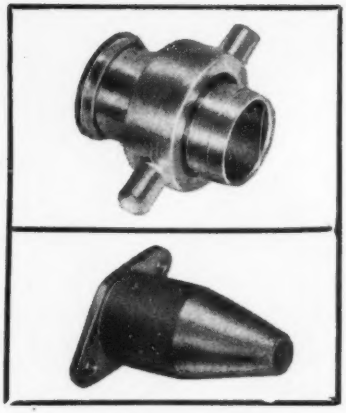
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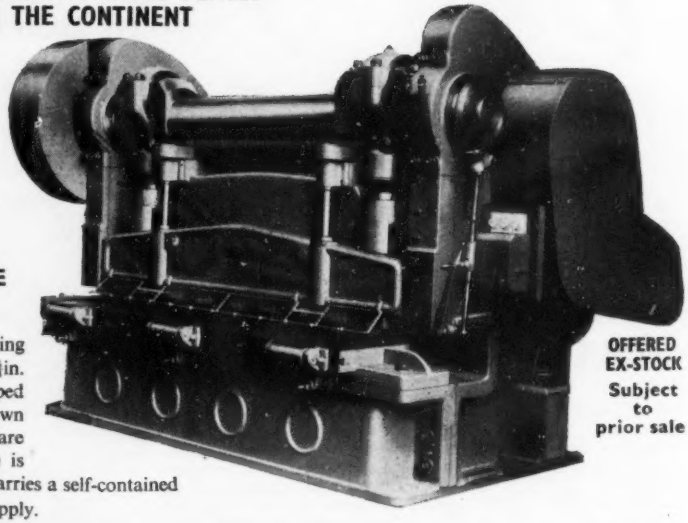
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Size of machine		No. 6	No. 10	No. 14*	No. 20
Capacity in zinc base	lbs.	$\frac{3}{4}$	$2\frac{3}{4}$	7	12
Capacity in aluminium	lbs.	—	$1\frac{1}{4}$	$4\frac{1}{2}$	8
Max. die size	ins.	$8\frac{1}{4} \times 9\frac{1}{2}$	16×10	24×14	30×20
Stroke of platen		$4\frac{1}{2}$	6	9	12

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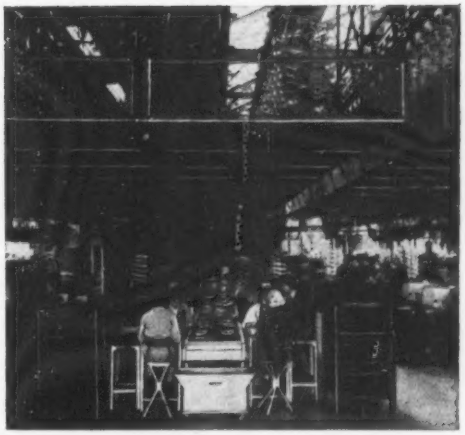


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For years, batch production has been the traditional method of producing pressure die castings. Line production, the " experts " told us, was out of the question. Our development engineers thought differently and our directors gave them full support. The degree of success our new " die-line " foundry has achieved can be summarised best by a few more quotations from leading technical, industrial and financial publications. " *Ten day production cycle reduced to 24 hours . . . 50 per cent. more castings from the same floor area . . . production from raw materials to finished component under constant supervision . . . wasteful handling practically eliminated.*"

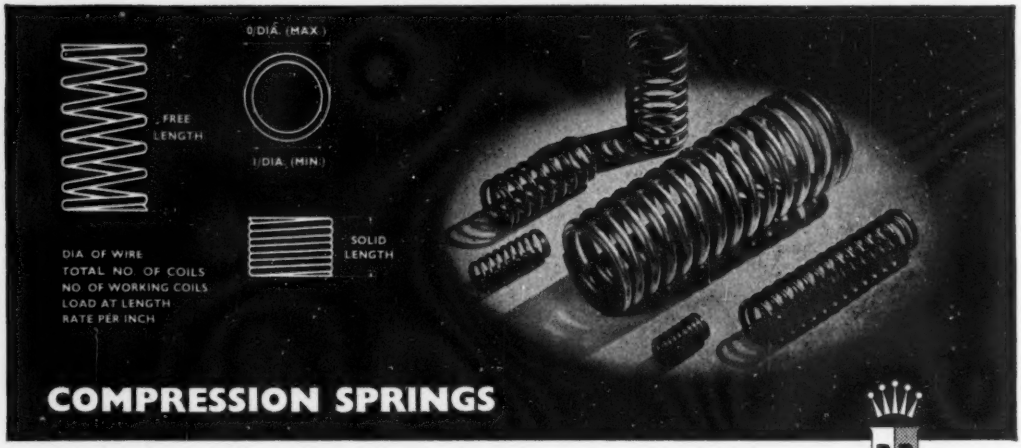
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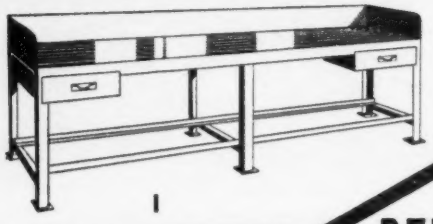


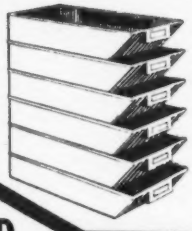
This photograph shows a few examples of high-quality precision springs, made by Riley. Some were produced to customers own specifications, others were the result of recommendations by the Riley design and research department. If you have any kind of spring problem, Riley will find the answer to it.
(The diagram shows information required when ordering this type of spring.)

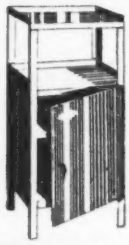
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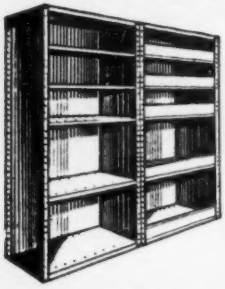
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1


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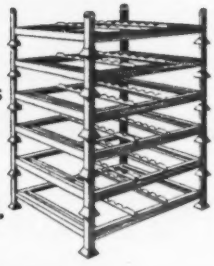

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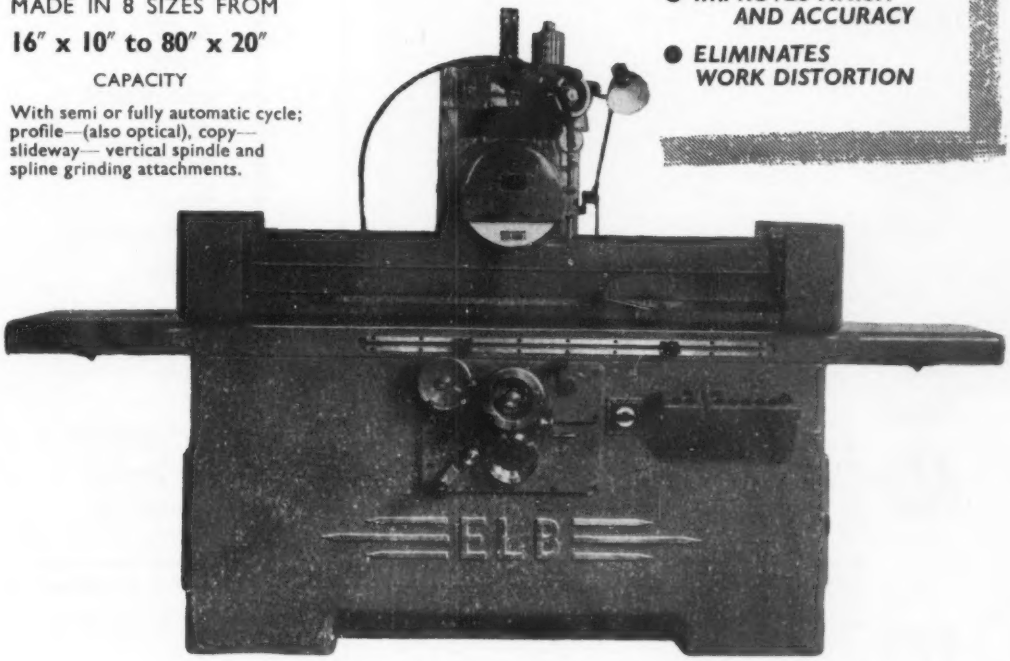
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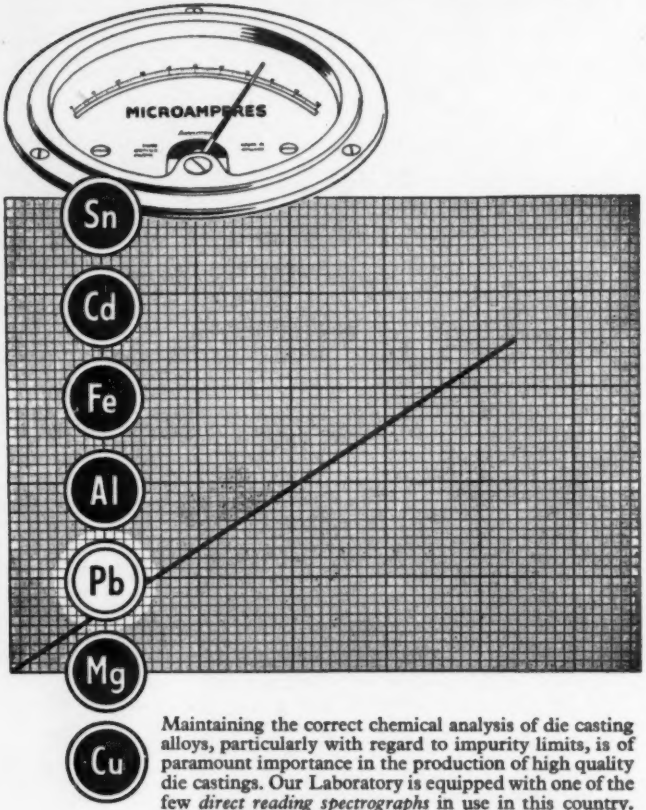
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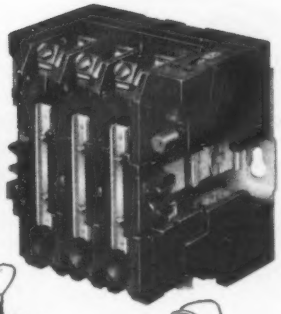
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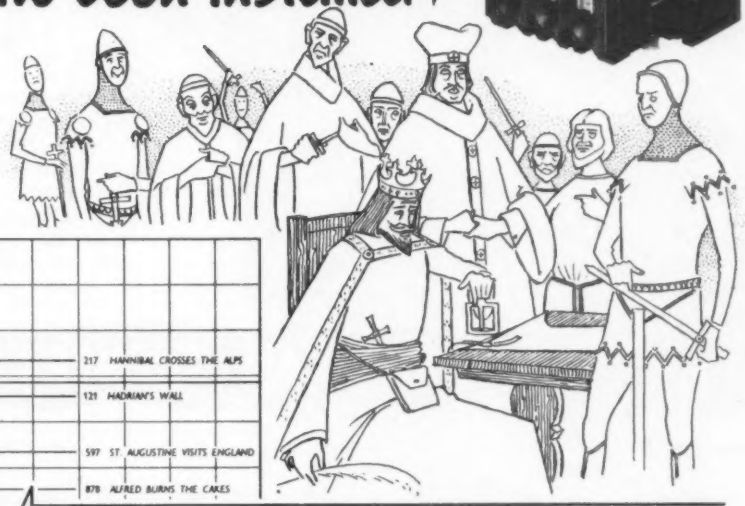
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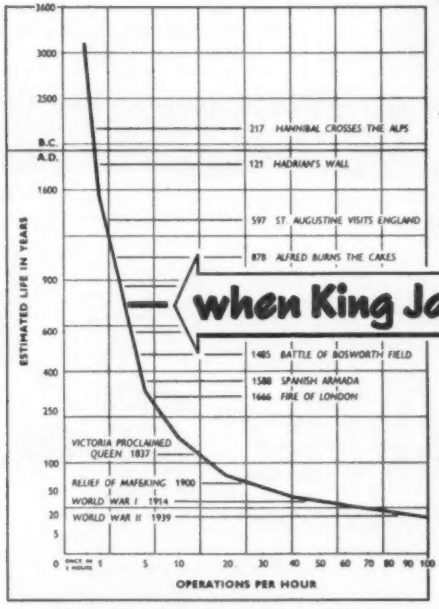
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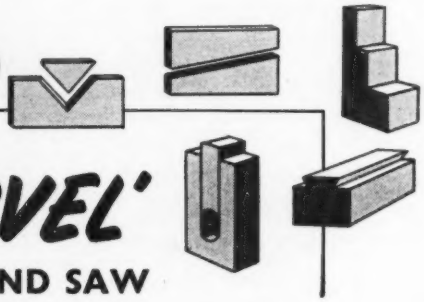


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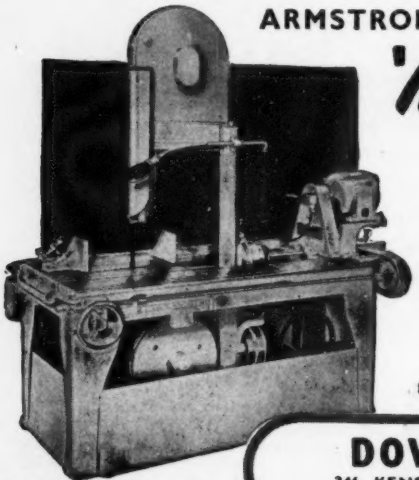
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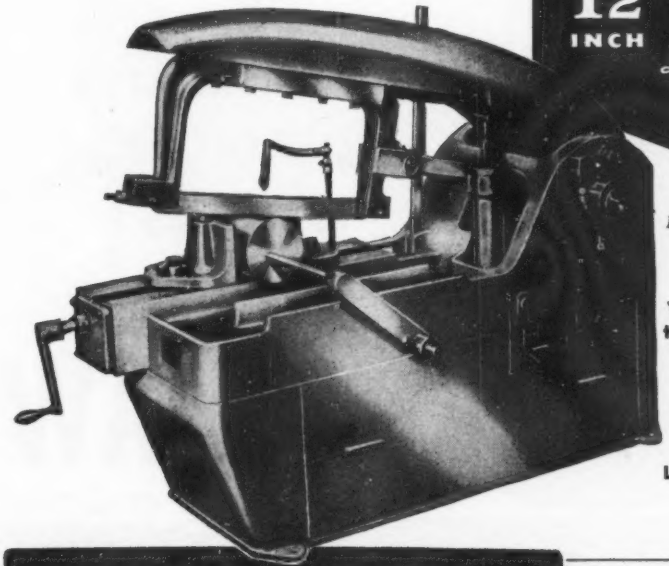
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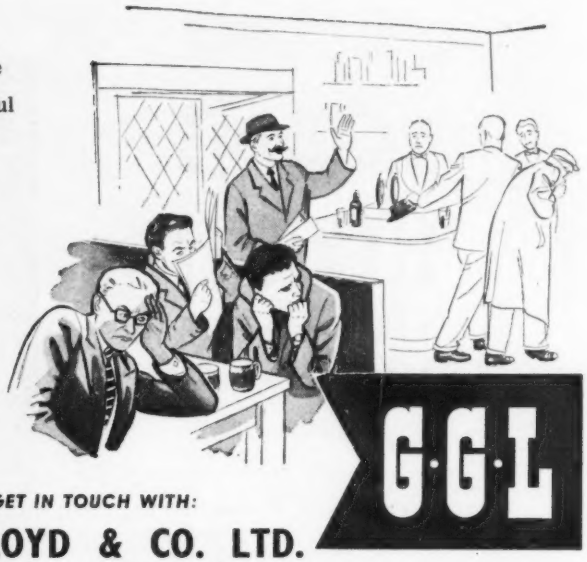
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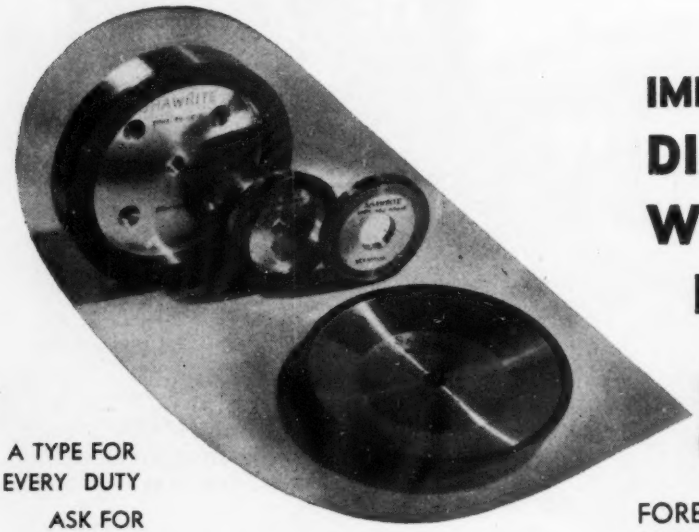
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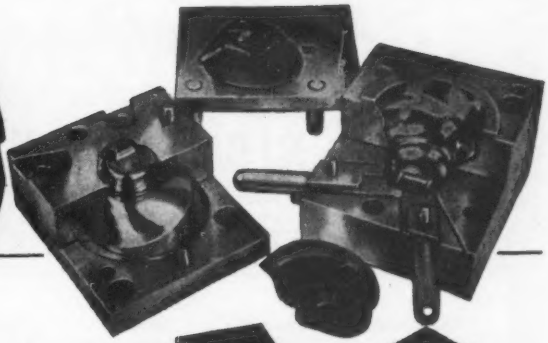
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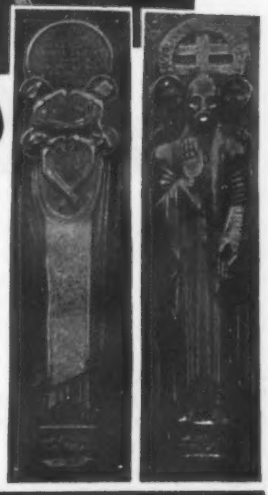
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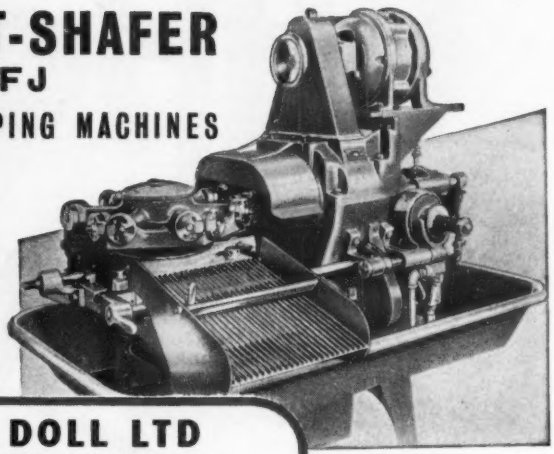
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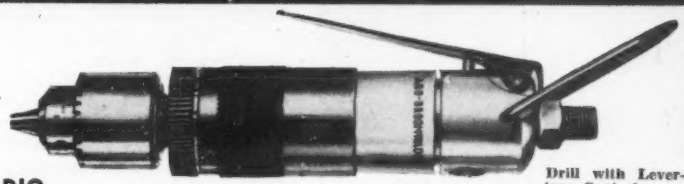
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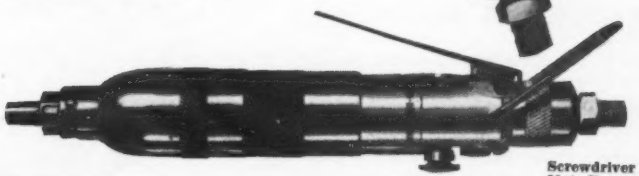
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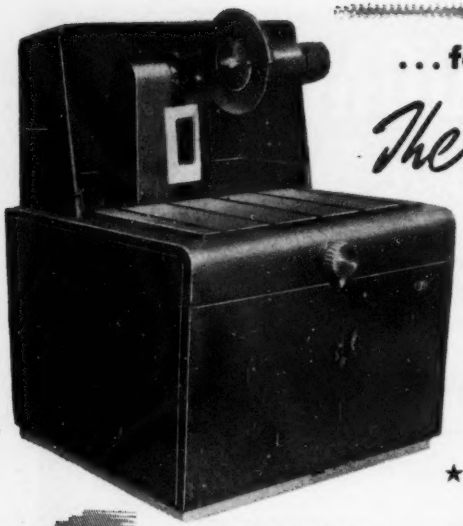
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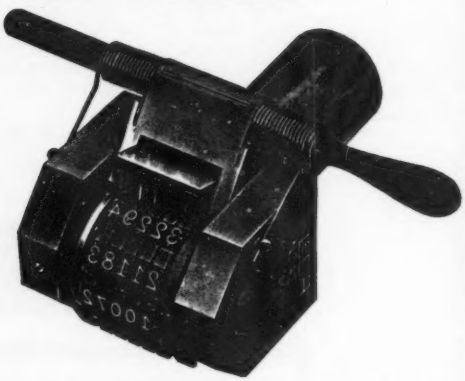
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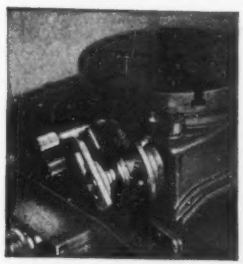
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Close-up showing dividing attachment on rotary table

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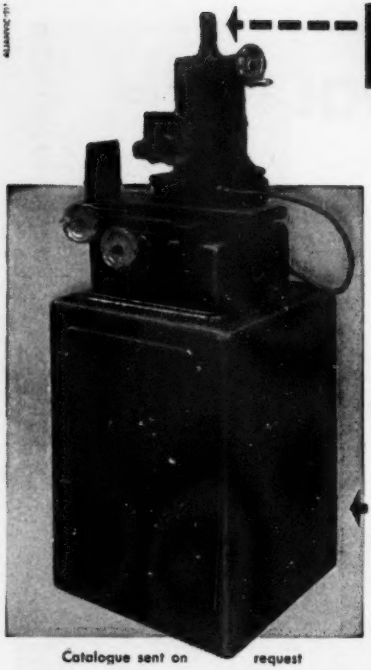
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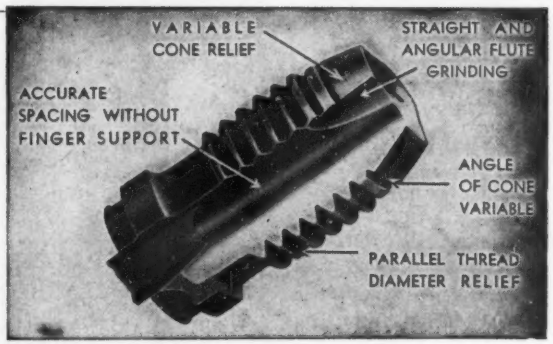
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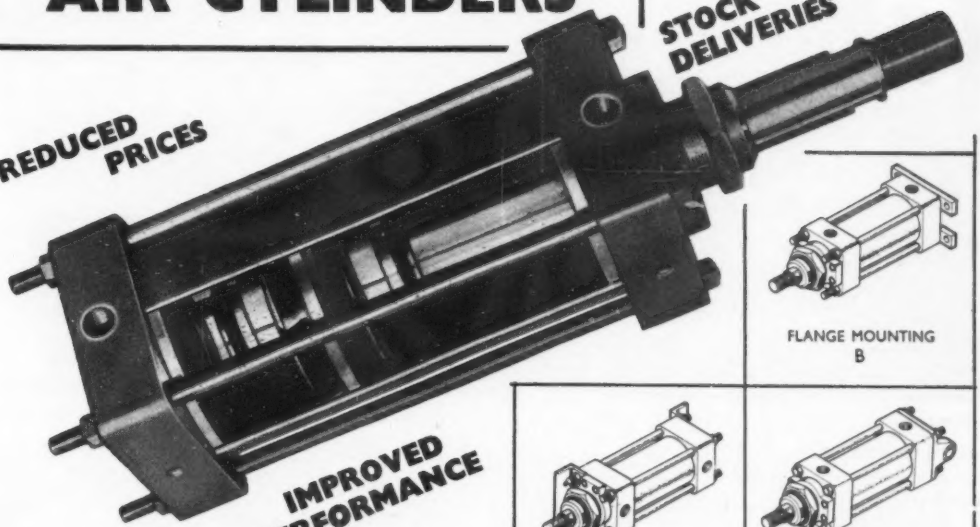
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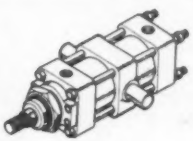


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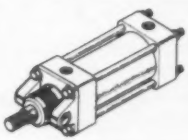
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C

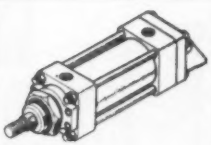
REAR
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D



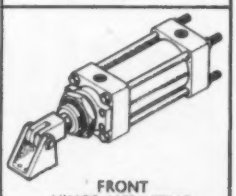
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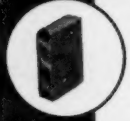
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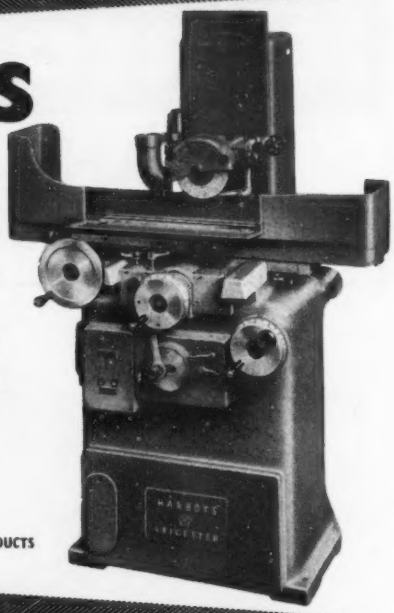
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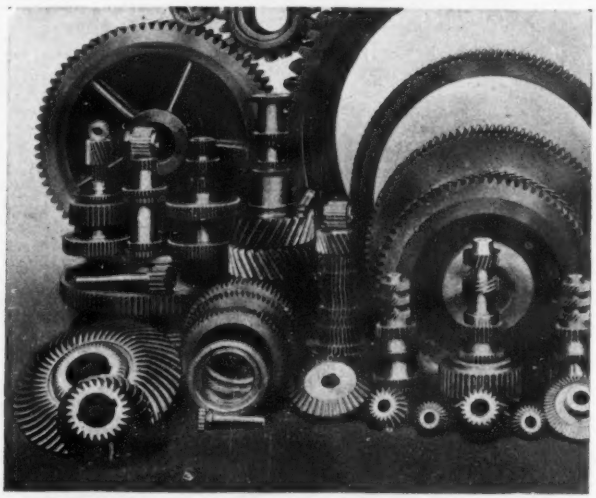
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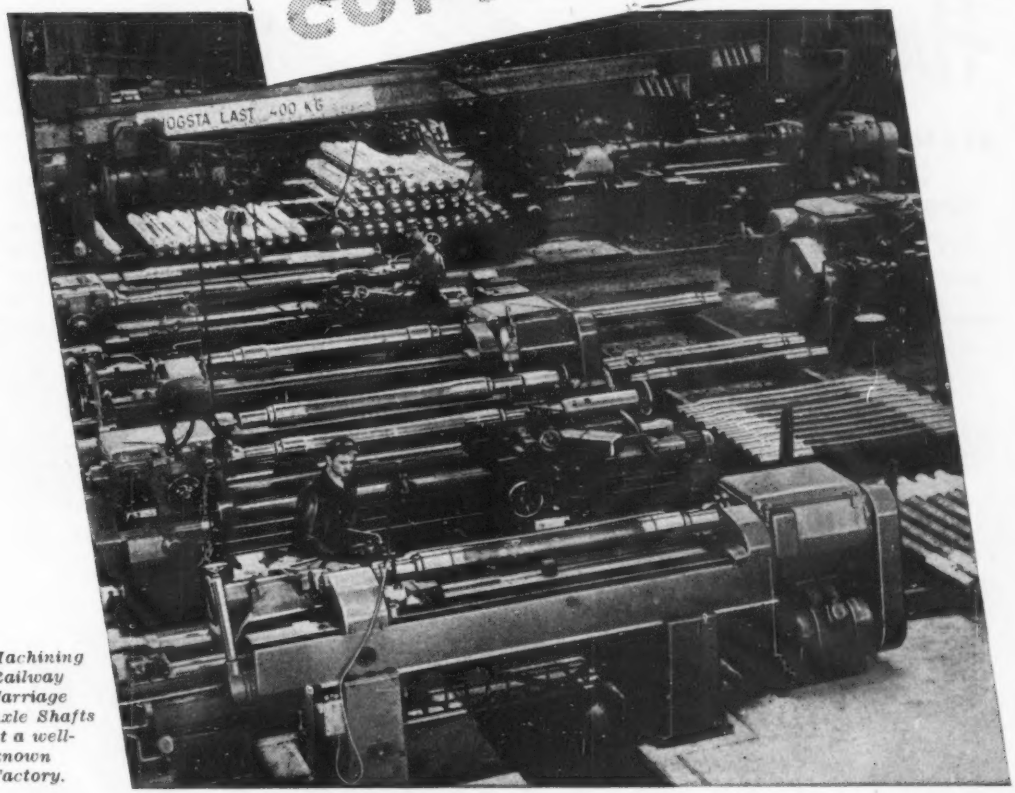
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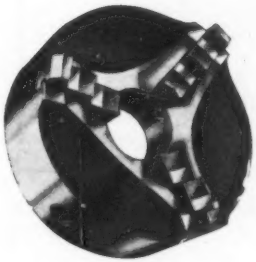


Fig. 1.

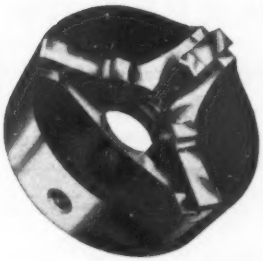


Fig. 2.

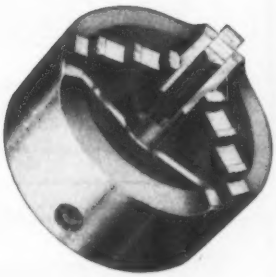
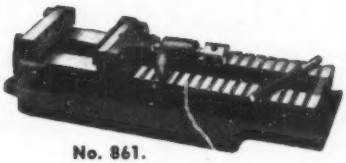
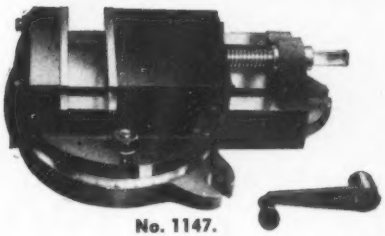


Fig. 552.



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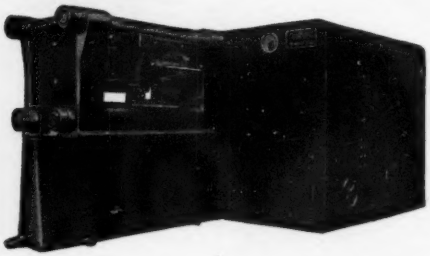
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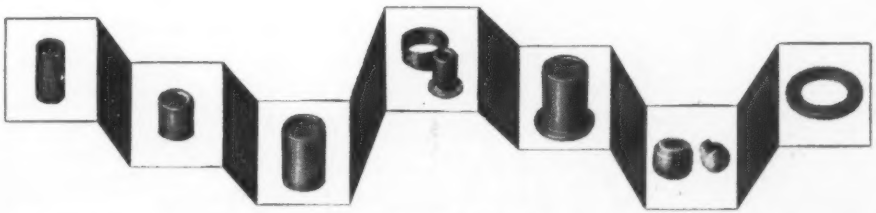


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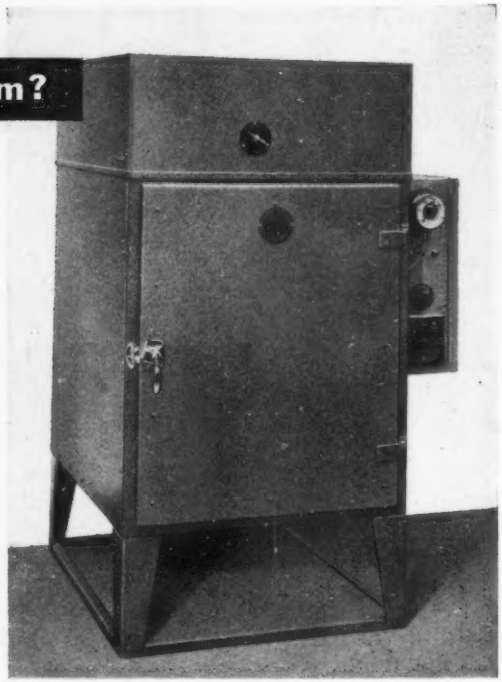
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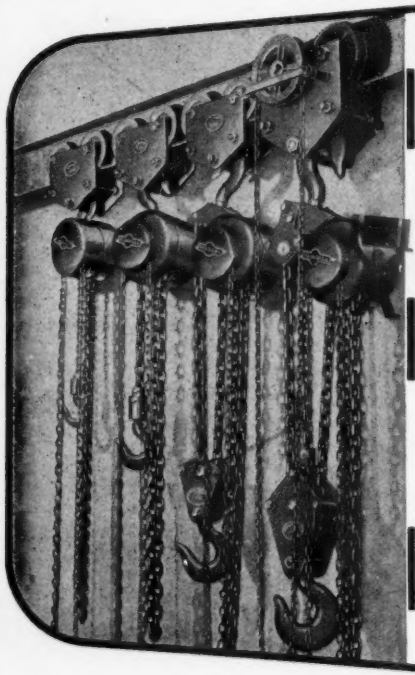
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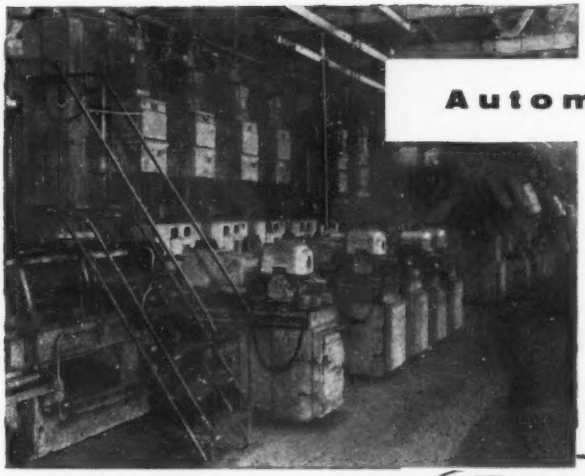
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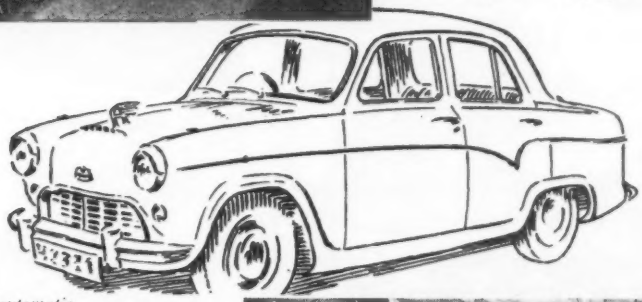
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(Above) A non-platen automatic in-line transfer machine with 33 working stations, drilling, tapping, reaming, trepanning and milling 'B' series BMC cylinder blocks. Vickers-Detroit Oil Hydraulic Equipment controls the load and eject cylinders, the clamping and transfer mechanisms.

(At right) A non-platen automatic in-line transfer machine with 17 working stations, drilling, reaming and tapping front and rear ends, machining thrust faces on centre crank bearing, boring cam, crank and water pump bores on 'B' series BMC cylinder blocks. Vickers-Detroit Oil Hydraulic Equipment controls the clamping and unclamping, the eject cylinders and the transfer mechanism.



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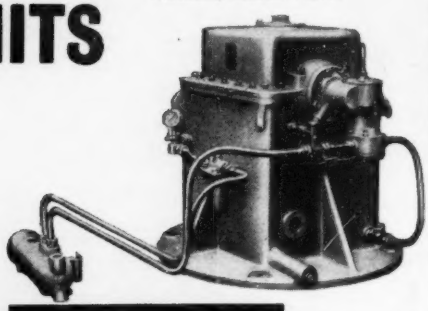
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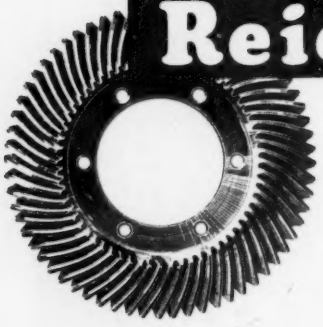
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The illustration shows a VSB 16in. Spiral Bevel Gear unit for a Turbine driven Vertical Centrifugal Pump.
200 h.p. at 2,900 r.p.m.
1/1 ratio, 24 hours rating.
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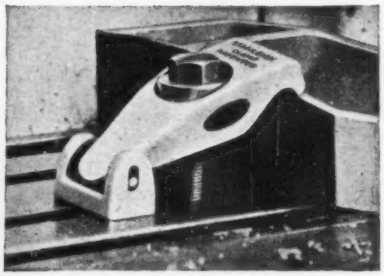
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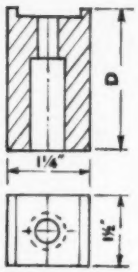


SIZES AND CAPACITIES

Size No....	4	6	8
Length of clamps	4in.	6in.	8in.
Width of clamp	1¼in.	2¼in.	2¼in.
Ball washer for bolt size	⅛in. or ¼in.	¼in. or ⅜in.	¼in. or 1in.
Capacity (height adjustment) without packing block	2in.	2½in.	3in.

Eliminates Loose Packing, Bad Clamping and Bent Bolts.

J & S—Stanleigh Universal Clamps are a practical and economical aid to increased production. They are manufactured in three standard sizes to give 2in., 2½in. and 3in. height adjustments. The clamps are fully universal, making a perfect clamping contact at any height from zero to the maximum capacity and allow up to 15 degrees tilt all the way up by simply tightening a nut, which does not distort the bolt.



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PACKING BLOCKS

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Size (D): 1in., 2in. and 3in.

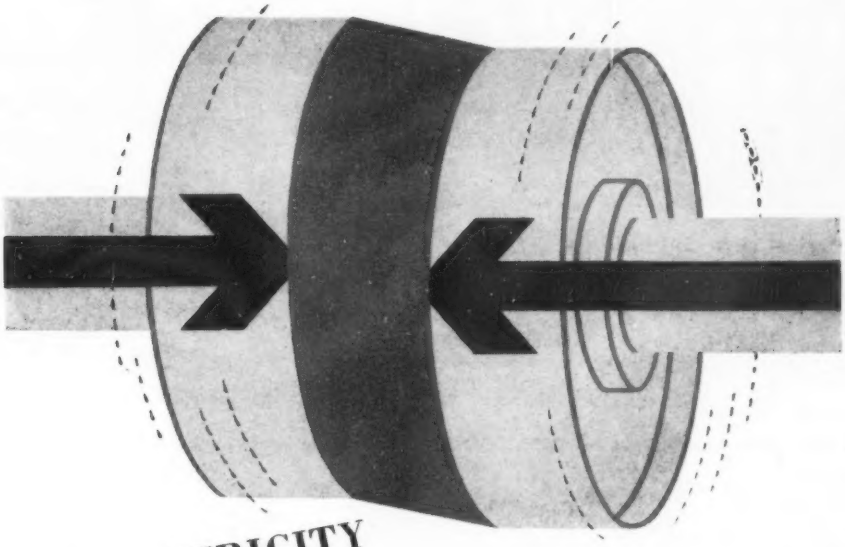
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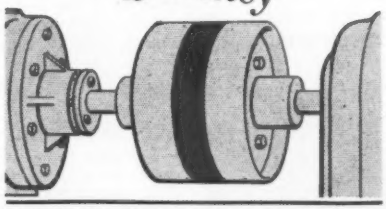
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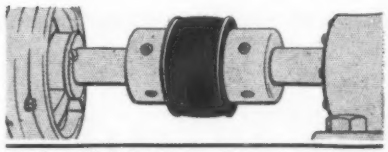
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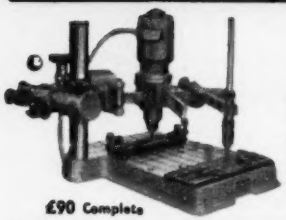
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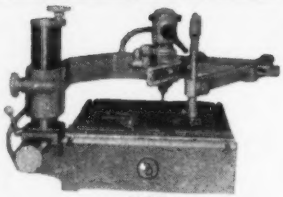
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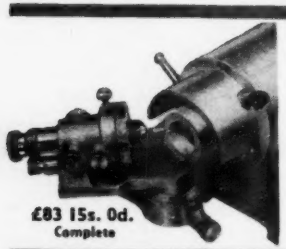
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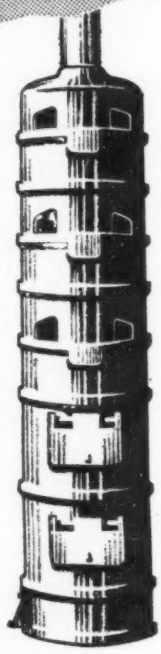
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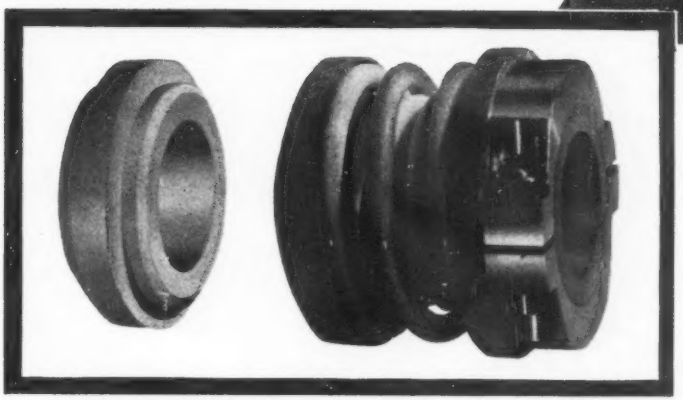
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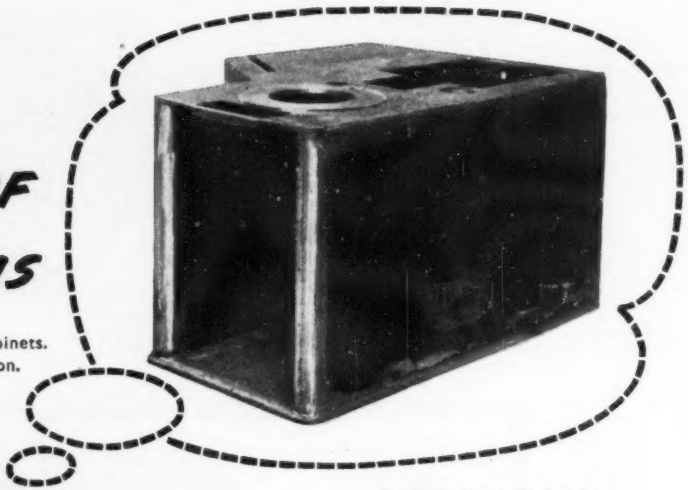
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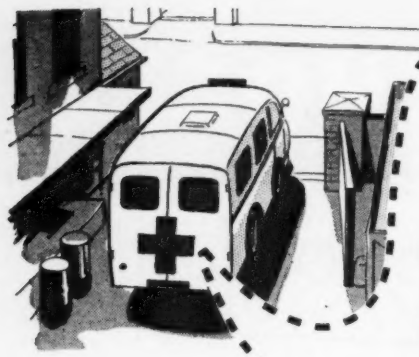
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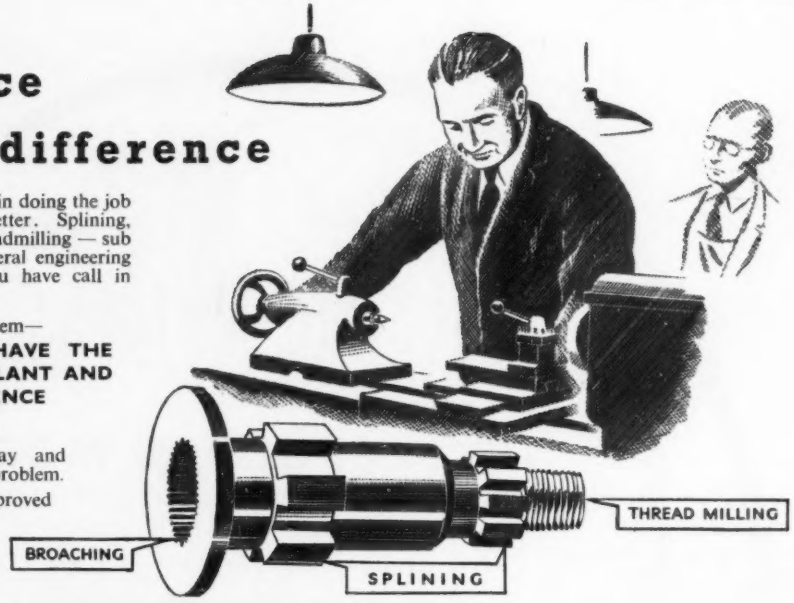
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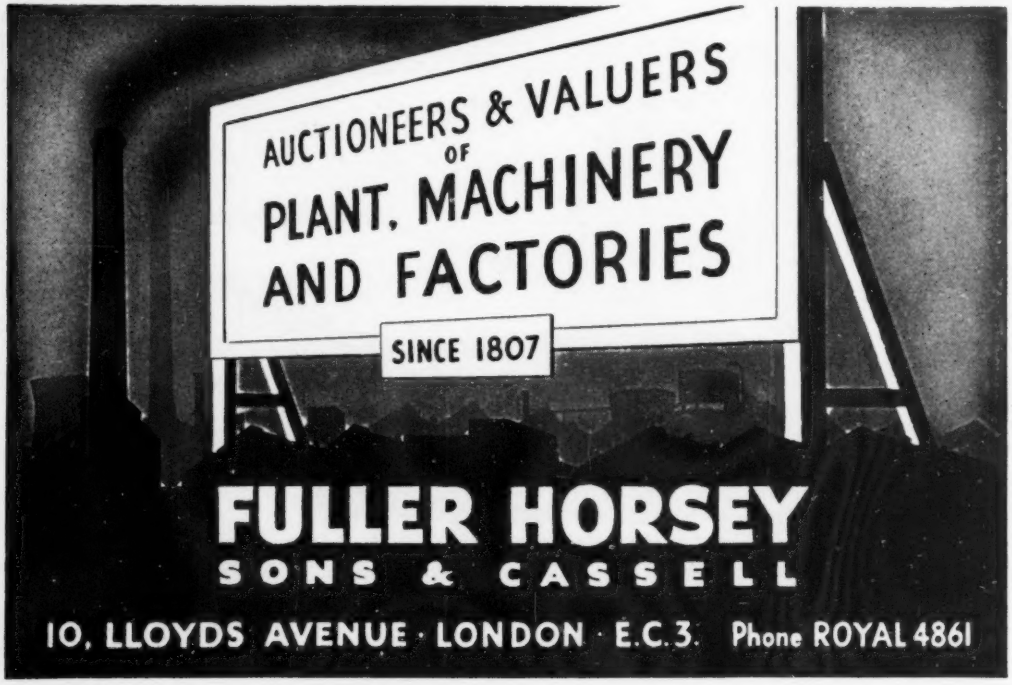


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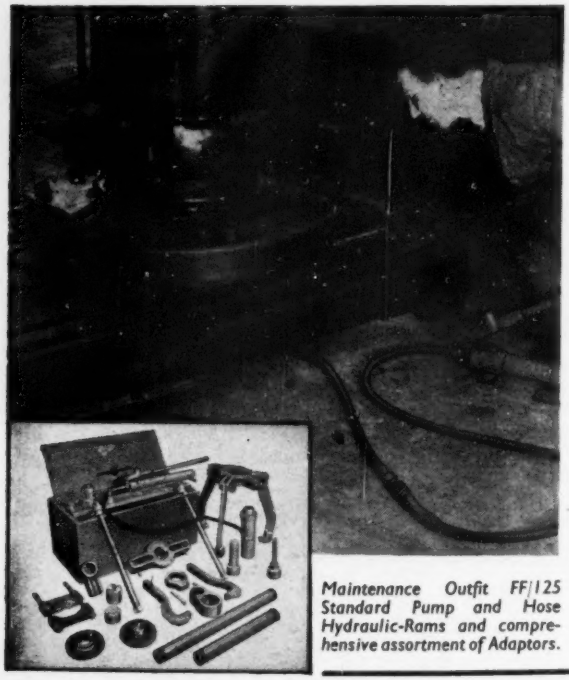
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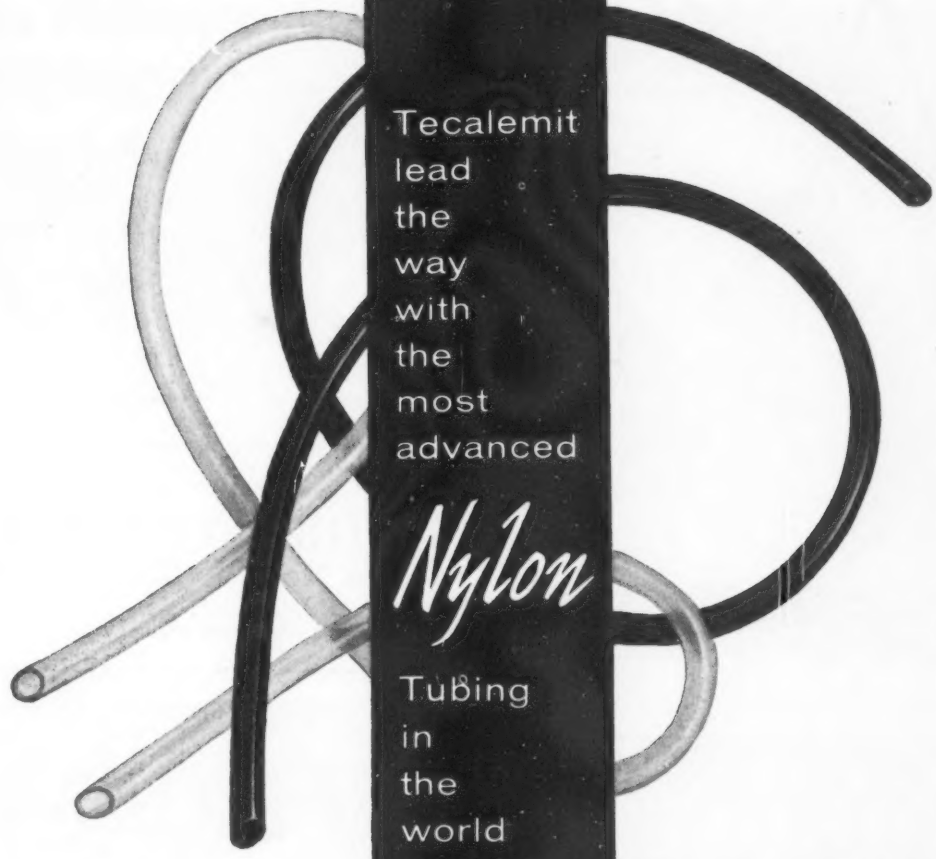
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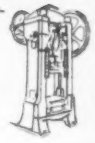
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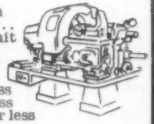
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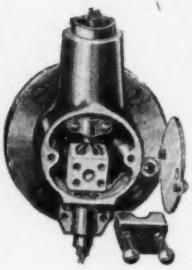
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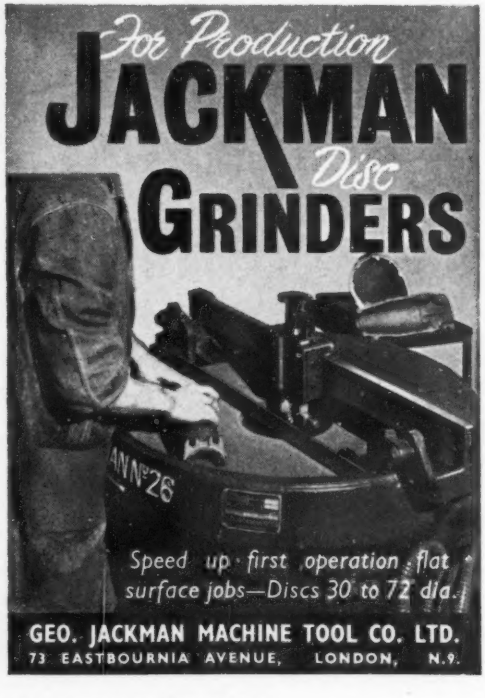
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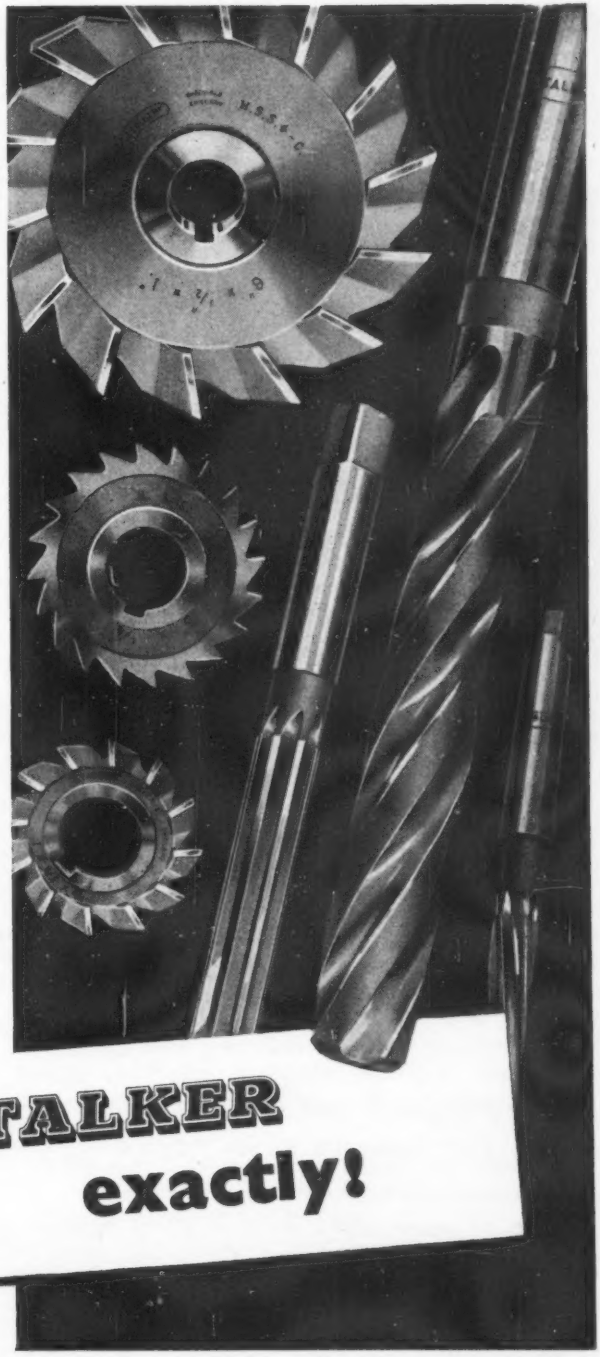


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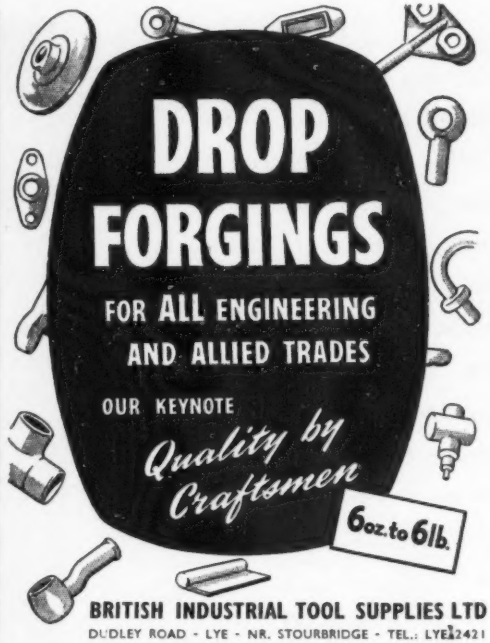


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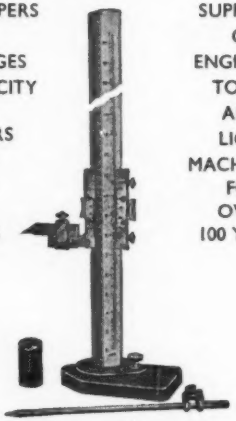
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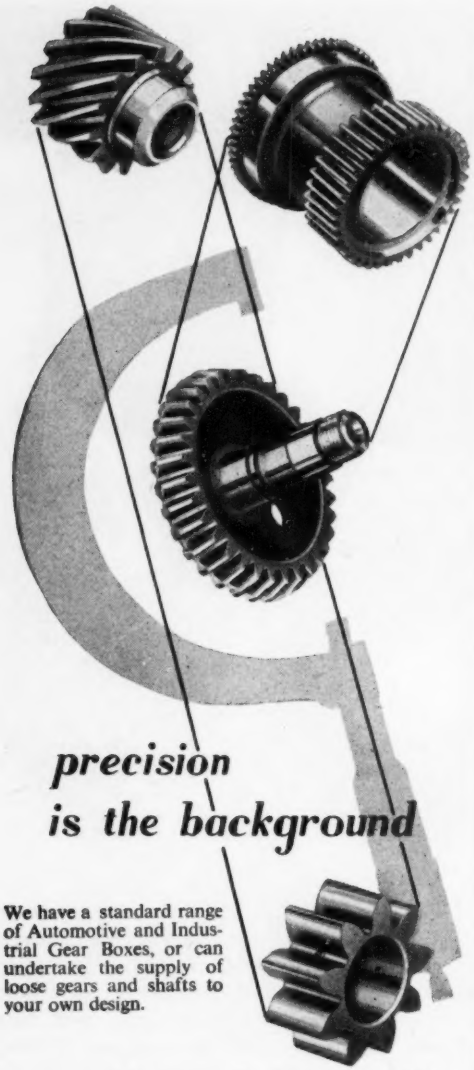
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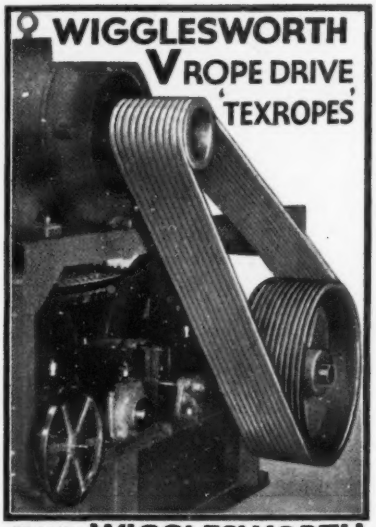
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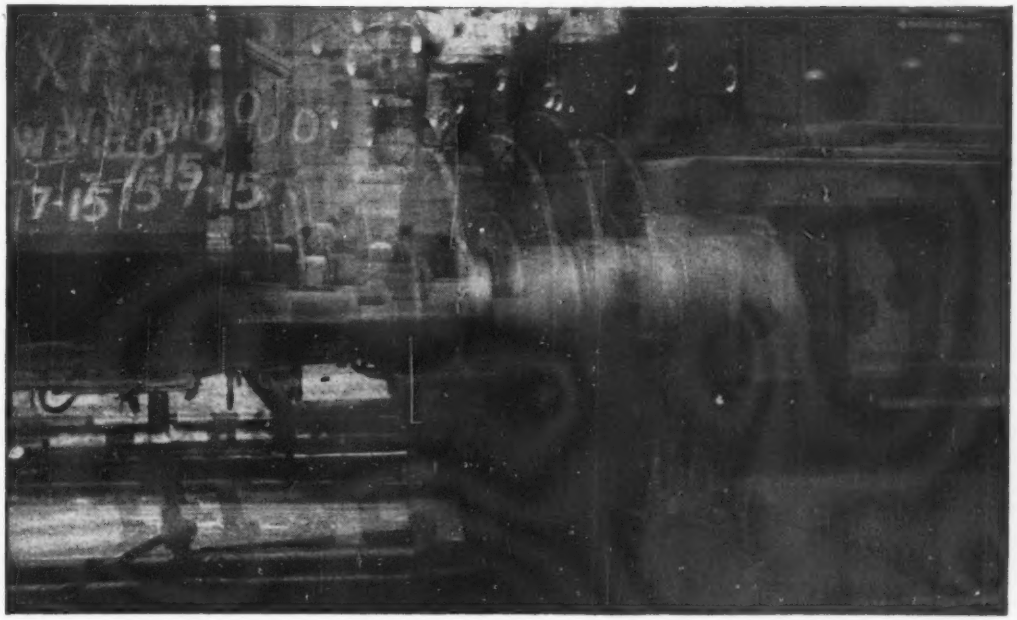
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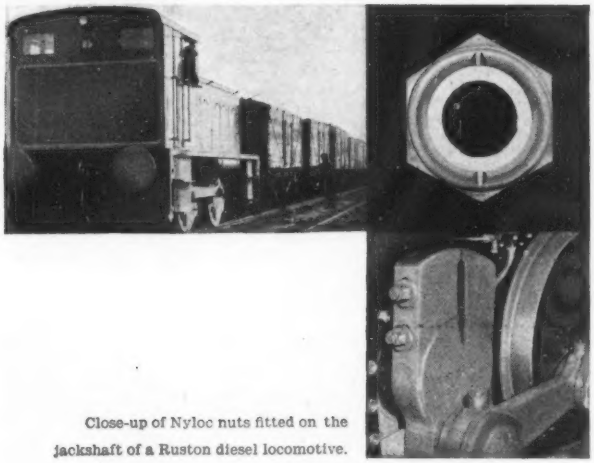
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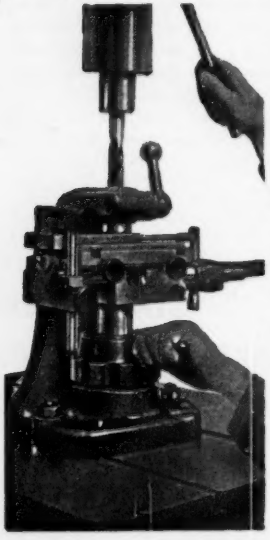
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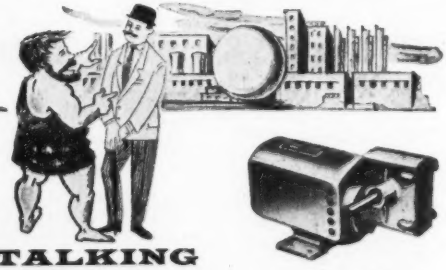
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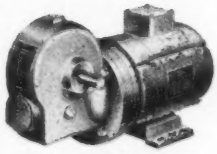
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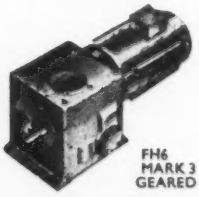
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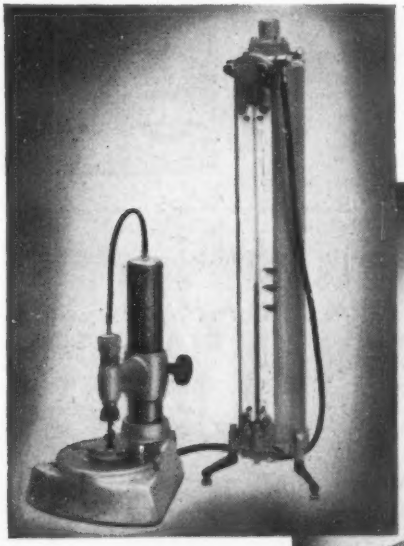
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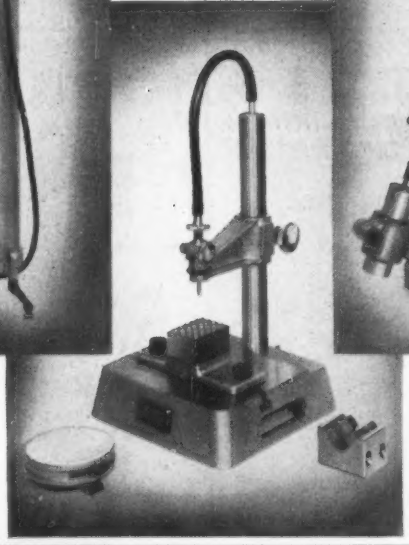
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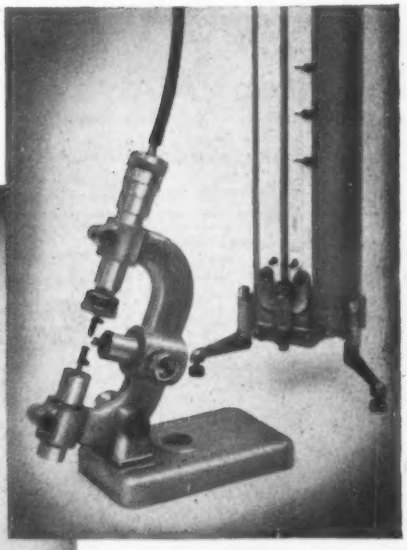
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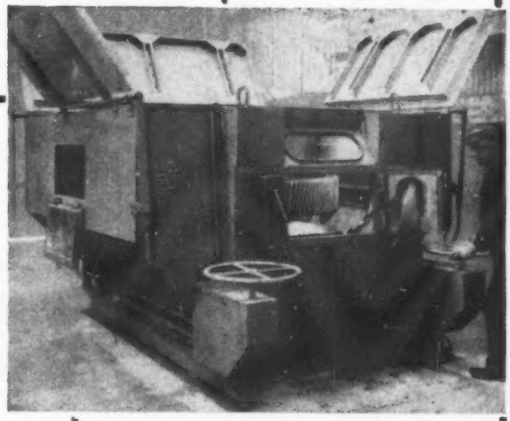
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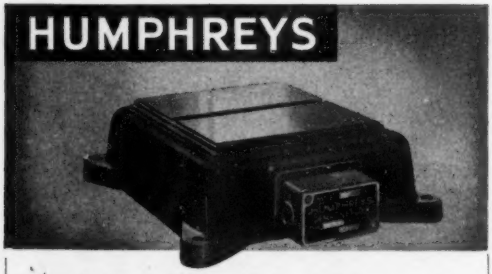
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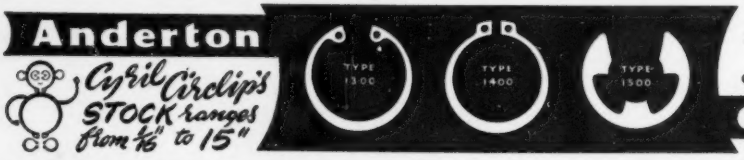
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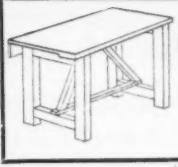
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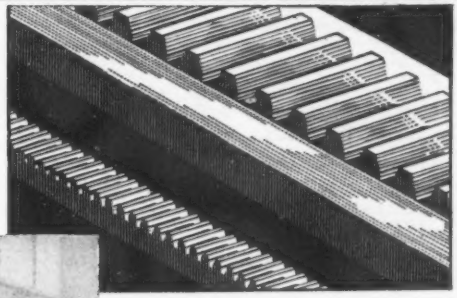
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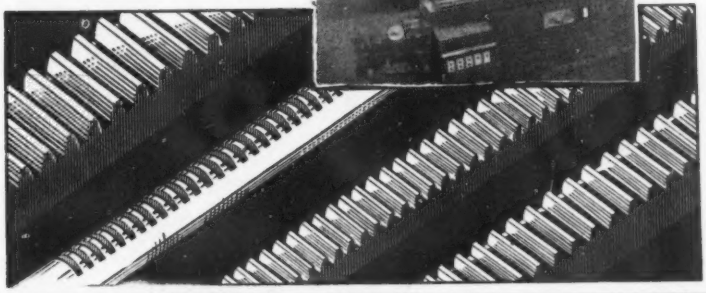
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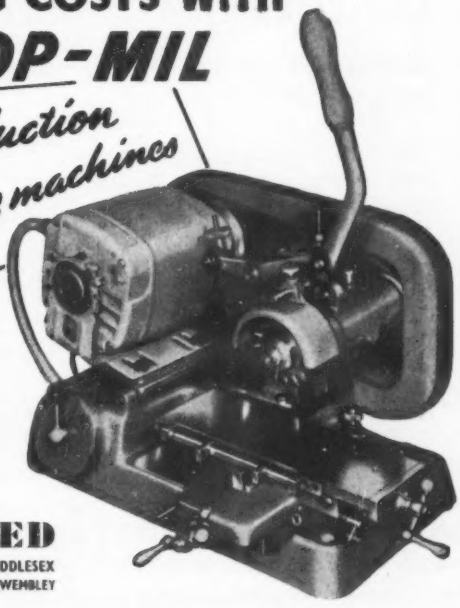
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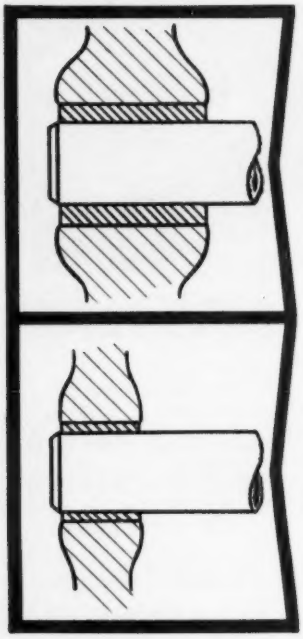


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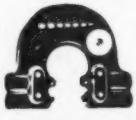
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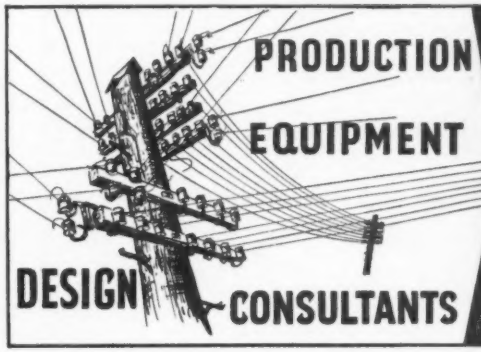
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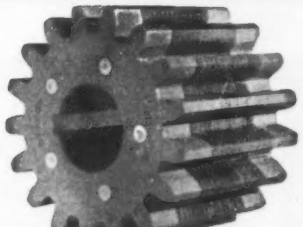
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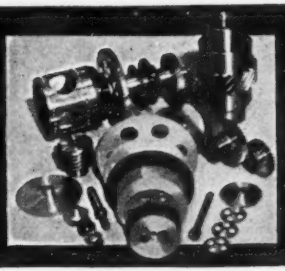
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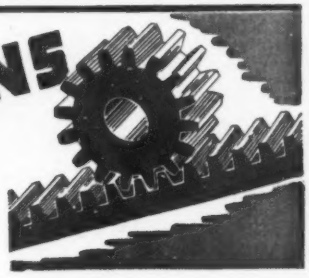
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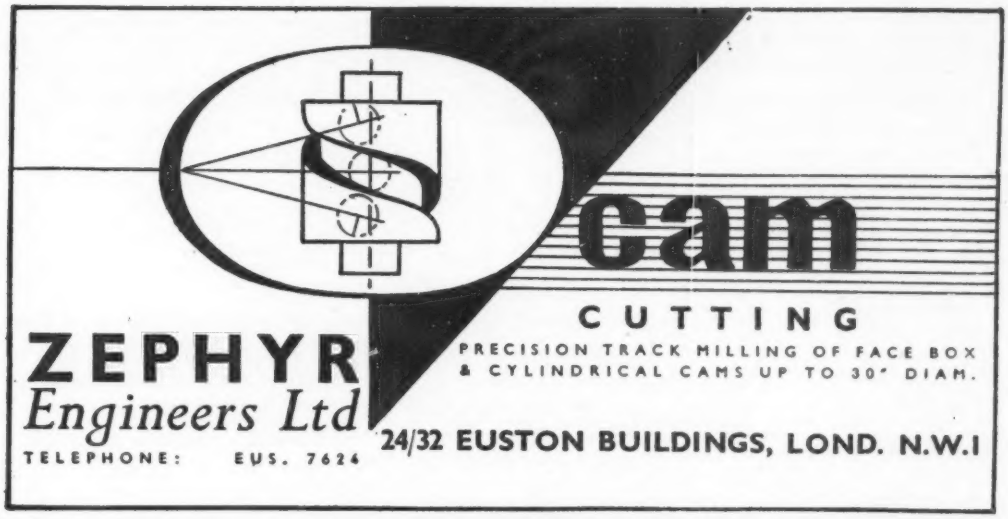
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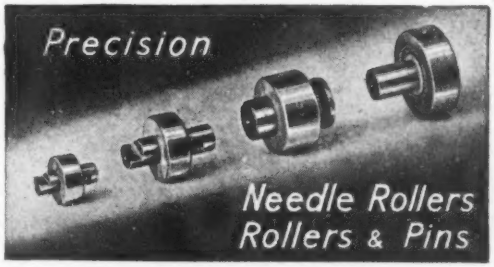
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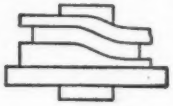
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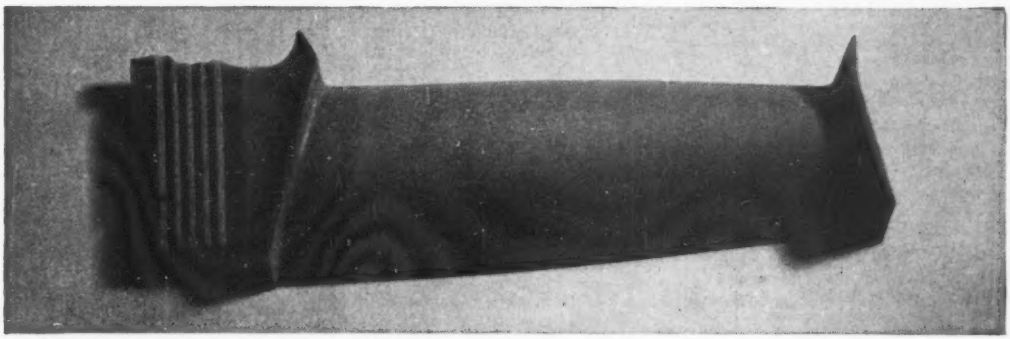
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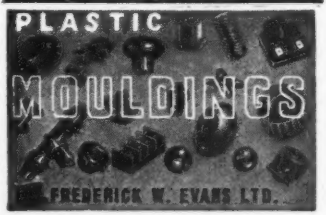
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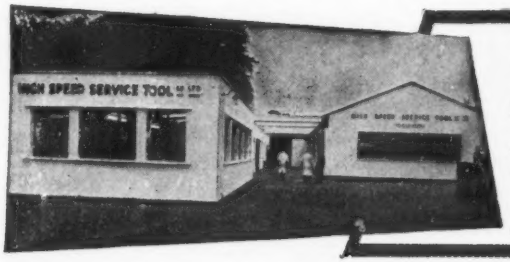
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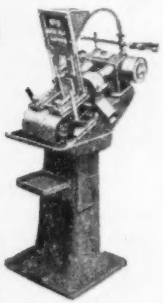
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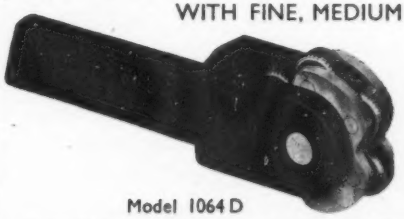

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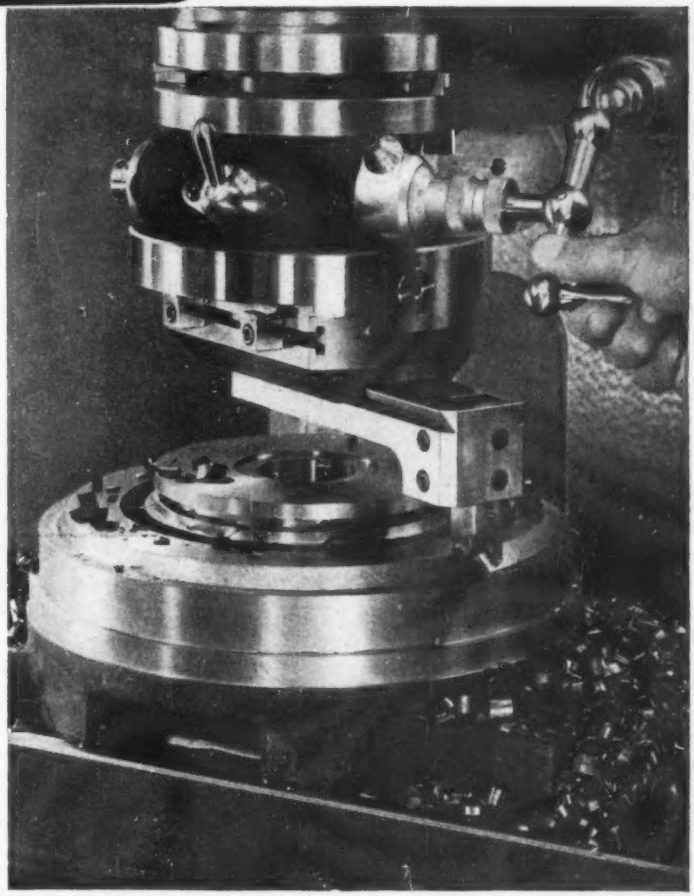
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LIBBY Model 4A Capstan Lathe.
OLDFIELD & SCHOFIELD Surfacing and Boring Lathe, 10½in. centre height by 33in.

DRILLING MACHINES

KITCHEN & WADE 28V10 Single Spindle Vertical Drilling Machine, No. 4 M.T.
HETTNER Radial Drilling Machine, having 10ft. Radial Arm elevating column type.
KITCHEN & WADE 4ft. 6in. Radial Drilling Machine.
TOWN 30in. Vertical Spindle Boring, Drilling and Tapping Machine. No. 5 M.T.
ASQUITH OD1 6ft. Radial Drilling Machine.

GEAR MACHINES

MUIR 72in. spur and helical Gear Generating Machine.
KOLB Gear Grinding Machine.
GLEASON No. 9 Bevel Gear Completor Machine.
ORCUTT Model HM.24 Internal Spur Gear Grinding Machine.
SYKES V.10 Gear Generator.
GLEASON 3in. Bevel Gear Generators. (Two available.)

GRINDING MACHINES

New **EXCEL** No. 3 Hydraulic Surface Grinding Machine.
CHURCHILL Universal Grinding Machine, 10in. by 24in. between centres.
B.S.A. LANDIS Type "C" Plain Hydraulic Cylindrical Grinding Machine, 6in. by 30in. (Two available.)
CHURCHILL Model HBY Internal Grinding Machine.
BLANCHARD No. 10 Vertical Spindle Surface Grinding Machine.
LANDIS Hydraulic Universal Grinding Machine 14in. by 36in. between centres.
LANDIS Type D Hydraulic Crank Pin Grinding Machine, capacity 21in. by 72in.
LANDIS Type "C" Plain Hydraulic Cylindrical Grinding Machine, 10in. by 36in.
NORTON 6in. by 18in. Plain Cylindrical Grinding Machine.
ABWOOD Vertical Spindle Surface Grinding Machine, 6in. by 18in.
CHURCHILL Hydraulic Universal Grinding Machine, capacity 24in. by 72in.
New **TOS** Vertical Spindle Hydraulic Surface Grinding Machine, table 118in. by 24in.
New **TOS** Vertical Spindle Hydraulic Surface Grinding Machine, table 59in. by 12in.
New **TOS** Model BBZ.60 Centreless Grinding Machine, maximum capacity 2¾in. diameter.

MILLING MACHINES

MILWAUKEE No. 2H Vertical Milling Machine, table 50in. by 10in.
SUNDSTRAND Hydro-Screw Rigidmill Automatic Production Milling Machine, table 7in. by 14in., table traverse 48in.
MILWAUKEE No. 4H Plain Horizontal Milling Machine, table 74in. by 15½in.
VICTOMATIC Automatic Cycle Production Milling Machine, capacity 50in. by 10in.
REED PRENTICE No. 5 Vertical Milling Machine, table 68in. by 16in.
CINCINNATI Hydromatic 3/24 Duplex Production Milling Machine. (Two available.)
REED PRENTICE No. 6 Vertical Milling Machine, table 84in. by 20in.
CINCINNATI 1/12 Horizontal Production Milling Machine.
CENTEC Model 3R Automatic Production Milling Machine, table 6in. by 25in.
CINCINNATI 2M Universal Milling Machine.
REINECKER Vertical Milling Machine, table 51in. by 13¾in.
HERBERT No. 10 Vertical Milling Machine, table 31in. by 9¼in.

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STOCKBRIDGE 20in. Shaping Machine.
URQUHART LINDSAY & ROBERTSON ORCHAR Spiral Drive Heavy Duty Planing Machine, capacity 16ft. by 5ft. by 5ft.
STIRK HILOPLANE Planing Machine, four soleniod tool boxes, capacity 12ft. by 4ft. by 4ft.

MISCELLANEOUS

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ROWLAND 16in. Type AHC Hydraulic Abrasive Wheel Cutting-Off Machine.



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HERBERT 2D Capstan, B.C. and B.F.
WARD 10 Combination Turret Lathe.
HERBERT No. 8 Combination Turret Lathe, covered bed.
SMALLPIECE No. 6 M.S.L. Multi-Production Lathe.
HERBERT 5A Capstan chucking m/c.
HERBERT No. 4 Capstans, 4 chucking machines.
ACME 5W Turret Lathe, chuck machine.
HERBERT Model O Capstan, pneumatic bar chuck and bar feed.
WARD 3A Capstans, B/C and B/F. 2 M/cs.
WARD 2A Capstans, B/C and B/F.
D.S.G. 13Z MINOR 6½in. by 31in. S.S. & S.C. Lathe.

DRILLS.

KITCHEN & WADE 32in. Radial 3 M.T. Sens.
ARCHDALE Mod. 2220 Pillar, 1¼in. cap. p/feeds.
HERBERT Type "C" Pillar, 1¼in. cap., p/feeds.
JONES & SHIPMAN Fig. 921, 30in. Pillar 2in. cap., p/feeds.

GRINDERS.

CINCINNATI No. 2 Tool and Cutter.
CHURCHILL Mod. H.A.Y. Internal Hyd.
NEWALL 10in. by 36in. Plain Hyd.
ABRASIVE Mod. 3B Surface, cap. 8in. by 24in.
CHURCHILL Mod. N.B. Horizontal Surface cap. 6 in. by 18in.
SNOW Mod. OS72 Hor. Spindle Surface, hyd. cap. 72in. by 18in.
PALLAS No. 0 Surface, cap. 14in. by 5½in.
NEWALL Mod. L.U. 12in. by 36in. Hyd. Universal.
B.S.A. LANDIS Type "C" 6in. by 18in. Hyd. Plain.
CHURCHILL Mod. B.Y. Hyd. Angle Head Automatic, plain.
ABWOOD Vert. Spindle, Surface, cap. 18in. by 6in. (AS NEW.)
CHURCHILL Mod. H.C.B. Hyd. Auto. Sizing. Internal.

MILLERS.

MILWAUKEE Mod. 2HL. Plain.
KENT-OWEN No. 1/14 Hyd. Plain. 2 m/cs.
VAN NORMAN No. 2L Plain, table 45in. by 10in.
CINCINNATI Mod. 08 Vert., table 24in. by 6in.
HERBERT No. 1 Plain, with auto. feed.
ARCHDALE 20in. Plain, with rapid traverse.
CINCINNATI 18in. Manfg. Model O.K., table 34in. by 12in.
ARCHDALE 14in. Plain, table 27in. by 8in. long. travel 14in.
ASQUITH Type V Vert., table 50in. by 14in., long. travel 28in.

MISCELLANEOUS.

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CONOMATIC 1⅝in. capacity 6-spindle Automatic.
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PITTLER Model RE.11.60 Turret Lathes, high speed, 8⅛in. centres, 2⅛in. hollow spindle.
LANDIS 10in. × 24in. Type "C" Hydraulic Universal Grinder.
CINCINNATI Model 08 Production Miller, table 18⅛in. × 6½in.
CINCINNATI No. 2 Vertical Dial-type Millers, table 52½in. × 12½in.
WICKMAN ⅞in. capacity Sliding Head Precision Autos.
CLIFTON & BAIRD 30in. Metal Cutting Bandsaws, table swivels for mitring.
LIBBY 2H8 Universal Combination Turret Lathe, 13½in. centres, hole through spindle 8½in.
ARCHDALE 28in. Horizontal Plain Miller, table 49in. × 13in., 3-way power feed.
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CHURCHILL-CONOMATIC 6-spindle 1¼in. capacity Automatic.
CHURCHILL No. 1 Motorised Hydraulic Internal Cylinder Grinders, 10in. × 18in. capacity.
SCRIVENER No. 1 Controlled-cycle Centreless Grinder, magazine feed.
ROWLAND Model HDD Duplex Surface Grinder, max. between discs 7½in.
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RYDER No. 18 Vertical Autos, motor driven, max. length of workpiece 26in.
GOSS & DE LEEUW 8-spindle 6in. capacity Chucking Automatics.
GOSS & DE LEEUW 5-spindle 8in. capacity Chucking Automatics.
STANLEY 14½in. centre Gap Bed Boring and Facing Lathe.
RYDER No. 6 six-spindle Vertical Autos., capacity 6in. × 6in.
CHURCHILL PAH 10in. × 24in Universal Tool and Cutter Grinder.
CHURCHILL PBH Universal Grinder, capacity 16in. × 50in.
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KNIGHT No. 20 Vertical Milling and Boring Machine, canting table 9in. × 40in.
CINCINNATI No. 2 Dial-type Horizontal Miller, table 49in. × 12in.
MILWAUKEE 2K Horizontal Dial-type Miller, table 56in. × 12in.
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SWIFT 9½in. by 51in. V.3. Type S.S. & S.C. Gap Bed Centre Lathe, Taper Turning.
SWIFT 11½in. by 69in. V.3 type S.S. & S.C. Centre Lathe.
BINNS & BERRY 12½in. S.S. & S.C. Gap Bed Centre Lathe, type TB. admits 7ft. 6in. between centres and 4in. dia. through spindle. NEW.

DRILLING MACHINES

KERRY Super 8 speed Bench Drilling Machine, ½in. capacity.
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3,000 kg. Capacity Avery Hardness Testing Machines, 10in. dia. table (2).
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WILSON 8½in. Lathe, 5ft. 10in. between centres.
WILSON 7½in. Lathe, 4ft. 8in. between centres.
WILSON 6½in. Lathe, 2ft. between centres.
CARDIFF 7½in. Gap Bed Lathe admit 40in. between centres.
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EXCEL No. 3C Hydraulic Surface Grinder.
BURDETT 18in. by 6in. Hydraulic Horizontal Surface Grinder.
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BEACON & MILFORD 6in., 12in., 14in. and 16in. Tool Grinders.
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VICTORIA O2 Omnimill.
VICTORIA V1 Vertical Miller, 40in. by 11in.
VICTORIA V2 Vertical Miller, 45in. by 11in.
VICTORIA V3 Vertical Miller 60in. by 12½in.
SEGIC Vertical Miller, 22in. by 9½in.
TAYLOR Vertical Miller, 17½in by 5½in.
MARLOW Vertical Miller, 22in. by 6in.
RICHMOND No. 3 Vertical Miller, 48in. by 11in.
VICTORIA U0 Universal Miller, 36in. by 9in.
VICTORIA Universal Millers from 36in. by 9in. to 72in. by 15in. tables.
RICHMOND No 3 Universal Miller, 48in. by 11in.
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CHURCHILL No. 1 Planetary Grinder.
ORCUTT HM24 Gear Grinder, 1944.
KEARNS No. 2 Horiz. Borer, 1942.
RYDER WELLMAN Horiz. Borer, 3in. sp.
B. & S. 00G Autos., 1942.
LA POINTE 2SI, Horiz. Broach.
WEBSTER & BENNETT 36in. B. & T. Mill.
ACME-GRIDLEY 2¼in. S.S. Auto., 1942.
MODERN 6in × 18in. Surface Gdr., 1953.
CHURCHILL OSV 40in. × 10in. Vertical Spindle Surface Grinder, 1942.
ARCHDALE 30in. H.D. Pillar Drill, 1942.
GISHOLT 4, 5 and 1L Turret Lathes, 1941-43
WARNER & SWASEY 3, 5 and 3A Turrets.
HERBERT 2D, 4, 4 Senior Turret Lathes.
B. & S. No. 2 Vert. Mill, 1942.
WARD 2A and 3A Capstans, 1942.
ARCHDALE 14in. and 30in. Vert. Mills, 1942.
CINCINNATI 2MH & No. 2 Plain Mills, 1942.
HEALD 48A 8 End Borematics, 1941-44.
DEFIANCE No. 5 Hor Borer, 3in. sp., 1941.
D. S. & G. 8½in. × 126in. Gap Lathe
CINCINNATI No. 2 Vert. Mills, 1942.
B. & S. No. 2 Universal Grinders, 1941.
NEWALL 10 by 24/48 Grinders, 1942.
MONARCH Magnamatic Prod. Lathe, 1946.
ORCUTT 5in. × 36in. Spline Grinder, 1944.
V.D.F 10in. × 72in. Centre Lathe, 1941.
CINCINNATI 3/24, 3/36 Hydromatics, 1945.
HERBERT 0, 1 and 3S Plain Mills, 1940.
P. & W. 12B 2-spindle Profiles, 1941.
KITCHEN & WADE No. 2 Cyl. Hone, 1940.
CHURCHILL NB 6in. × 18in. S. Gr., 1942.
CHURCHILL Centreless Gr., Model EC, 1940.
COCHRANE RLV No. 55 Cold Saw, 1940.
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If you do not wish your reply to any Box No. advertisement in this section to be forwarded to certain firms, please advise us. Your reply will then be destroyed, but you will not be notified as this would disclose the identity of the advertiser.

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Works Superintendent for Progressive Trade Toolmaking Company required.

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Apply with full particulars to THE MANAGING DIRECTOR, BRISTOL TOOL & GAUGE CO., LTD., Church Road, Kingswood, Bristol.

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Replies, stating age, experience and salary required, to BOX Z734, MACHINERY, Clifton House, Euston Road, N.W.1.

General Factotum for Engineers, office in West London, able to read drawings and do a little typing. Responsible to Managing Director. Write stating experience and salary.—BOX Z742, MACHINERY, Clifton House, Euston Road, N.W.1.

Working Foreman for Small engineers, West London. Machining/assembly and control of labour. Salary £850 p.a. —Write stating experience to BOX Z743, MACHINERY, Clifton House, Euston Road, N.W.1.

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Please write giving age, experience, qualifications and salary required to **BOX Z.739, MACHINERY, Clifton House, Euston Road, N.W.1.**

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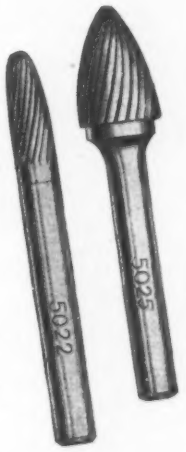
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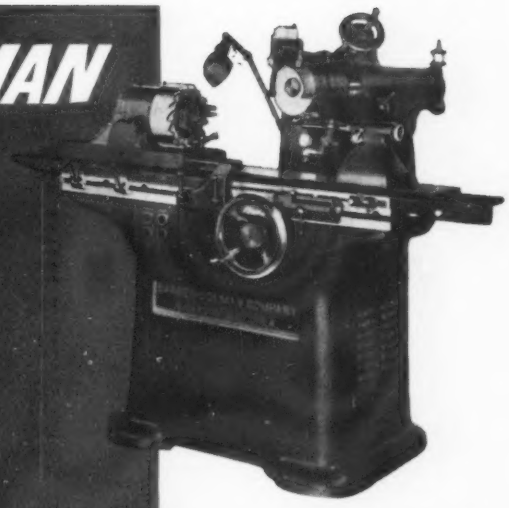
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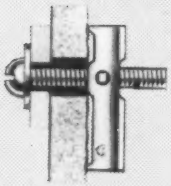
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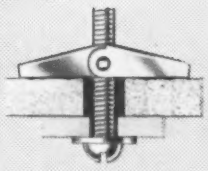
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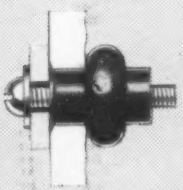
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A simple, ingenious and foolproof device for thin and hollow materials. A metal member is suspended off centre on the end of a screw. When inserted horizontally through the hole to the space behind, the long end falls into a vertical position by the pull of gravity. It is then drawn up against the reverse side of the material by turning the screw with a screwdriver.



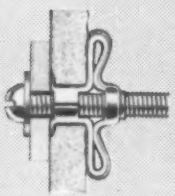
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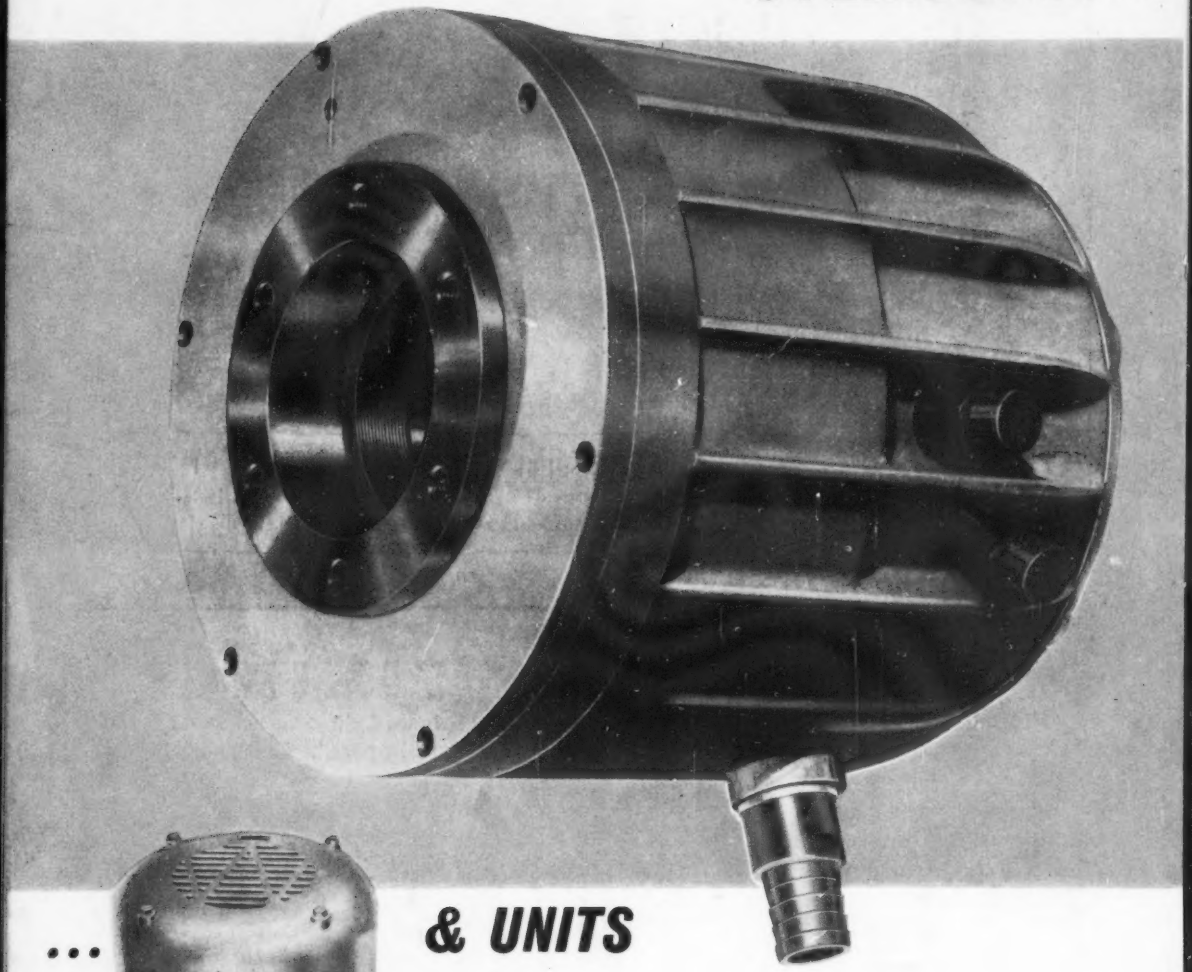
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